

# SANITARY ENGINEERING.

Part I—Sewage Disposal Number.

## CALIFORNIA STATE BOARD OF HEALTH.

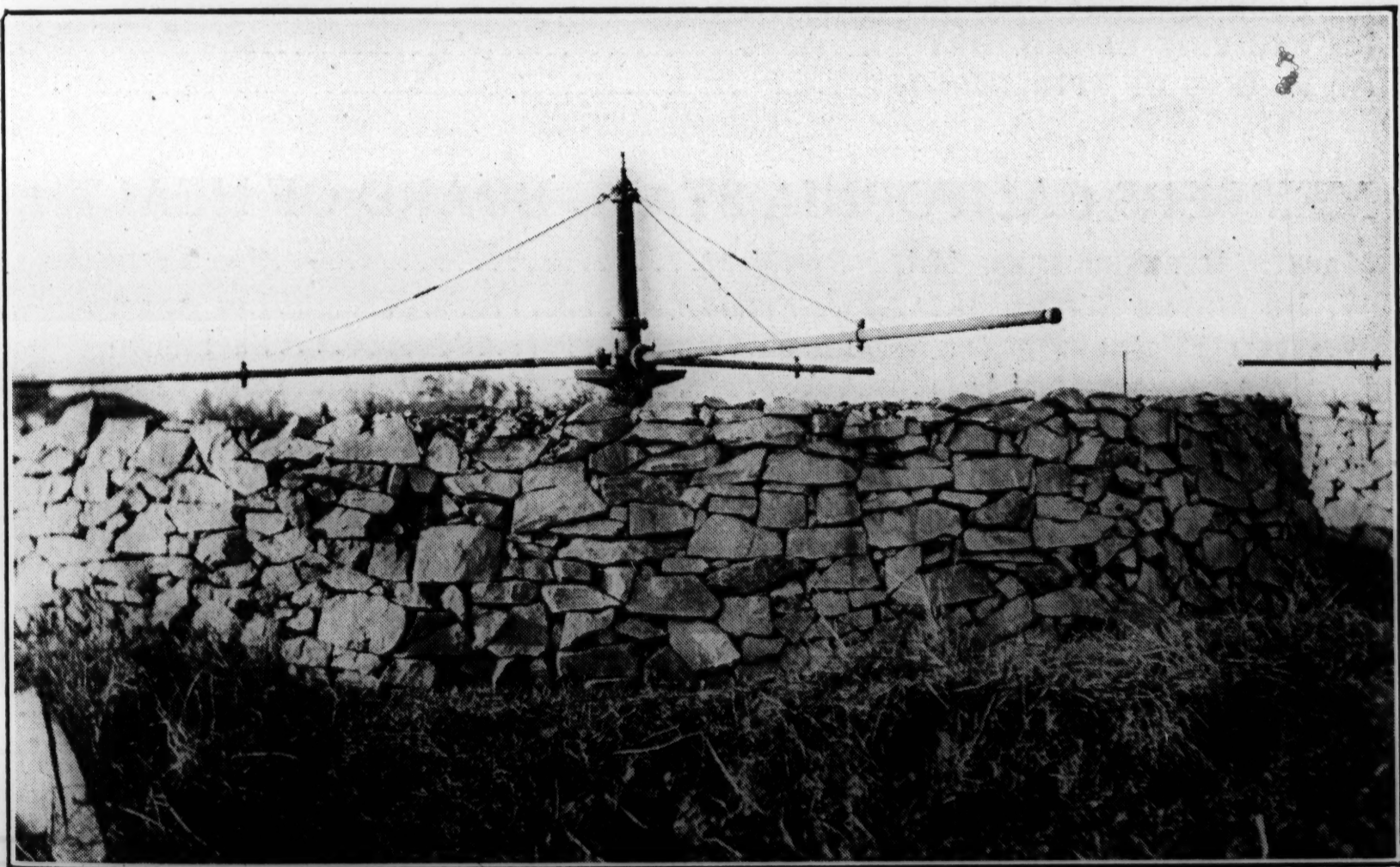
### MONTHLY BULLETIN

Vol. 6

MARCH, 1911.

No. 9

## THE SANITARY ENGINEER AND THE PUBLIC HEALTH.



MODERN WARFARE AGAINST DISEASE--A BIOLOGICAL FORTRESS

Forty California cities expended \$1,792,980 in new sewage "fortifications" alone in 1910. Water-purification expenditures and other sanitation bond issues still pending aggregate \$3,000,000 more. This is but one of many indications that California has begun the battle for Health Conservation in earnest.

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### REGULAR MEETINGS

The California State Board of Health meets regularly the first Saturday of each month, but the stated meetings of January, April, July, and October constitute the quarterly meetings required by law to be held at the Capitol of the State.

By courtesy of the University of California the Food and Drug Laboratory and the Hygienic Laboratory are located in University buildings at Berkeley, California.

Address all communications to the

SECRETARY, Sacramento, California.

# MARCH BULLETIN.

## THE SANITARY ENGINEER AND THE PUBLIC HEALTH.

By WILLIAM F. SNOW, M. D., Secretary California State Board of Health.

In August, 1894, Japan began her war with China. Ten years later she declared war against Russia. The following morbidity and mortality rates for these two wars are well worth serious thought:

| DISEASES.*   | Number of cases and deaths per 1,000 men engaged. |         |                            |         |
|--------------|---|---------|----------------------------|---------|
|              | Chino-Japanese war 1894-5.                        |         | Russo-Japanese war 1904-5. |         |
|              | Cases   | Deaths. | Cases.                     | Deaths. |
| Cholera..... | 82.77   | 50.86   | 0.00                       | 0.00    |
| Typhoid..... | 37.14   | 10.98   | 9.26                       | 5.16    |
| Malaria..... | 102.58  | 5.29    | 1.96                       | 0.67    |
| Totals.....  | 222.49  | 67.13   | 11.22                      | 5.83    |

It will be seen that, while the case-mortality in 1904-5 was fifty-one per cent for these three diseases as against thirty per cent in 1894-5, the army had 211 less men per thousand ill with these diseases in 1904-5 than in the war ten years before. To ascribe this great saving of life and prevention of disease to any single factor, or to administrative measures alone, would be unwarranted, but the facts themselves are remarkable, and serve to point the question, Has similar progress been made in reducing death and illness from these diseases among civil populations?

There is, perhaps, no common basis upon which to compare morbidity and mortality rates for armies and civil populations. The army problem deals with maximum conditions of crowding, fatigue, unknown water supplies, limitation of sanitary facilities, etc., but the soldiers themselves are specially selected for physical efficiency, are all adults, and are under strict military discipline. On the other hand, the civil population has an opportunity to safeguard its water supplies, sanitary and housing conditions, etc., but must deal with all classes and ages of people, and has practically no administrative control over the customs and carelessness of individuals. Nevertheless, demonstrations, such as that of Japan in reducing the world's average army record of four deaths from disease for one from wounds to one death from disease for four from wounds, suggest that more rapid progress should be made in stamping out preventable diseases among civil populations.

In California we have until recently failed to keep complete morbidity and mortality statistics, but the following figures for deaths from the

\* These figures are quoted from the Monthly Bulletin of State Board of Health, Rhode Island, Vol. XXII, No. 1, p. 23.

diseases given above are authentic, and the estimates of cases are conservative:

| DISEASES.    | Number of cases and deaths in California. |                  |                         |                  |                         |                  |                         |                  |                         |                  |
|--------------|---|------------------|-------------------------|------------------|-------------------------|------------------|-------------------------|------------------|-------------------------|------------------|
|              | 1906.                                     |                  | 1907                    |                  | 1908.                   |                  | 1909.                   |                  | 1910.                   |                  |
|              | Cases (esti-<br>mated).                   | Deaths (actual). | Cases (esti-<br>mated). | Deaths (actual). | Cases (esti-<br>mated). | Deaths (actual). | Cases (esti-<br>mated). | Deaths (actual). | Cases (esti-<br>mated). | Deaths (actual). |
| Cholera..... | 0   | 0                | 0                       | 0                | 0                       | 0                | 0                       | 0                | 0                       | 0                |
| Typhoid..... | 5,940*                                    | 594              | 5,580*                  | 558              | 5,400*                  | 540              | 4,610*                  | 461              | 4,710*                  | 471              |
| Malaria..... | 5,000*                                    | 100              | 3,500*                  | 70               | 4,000*                  | 80               | 5,600*                  | 112              | 5,650*                  | 113              |
| Totals ..... | 10,940                                    | 694              | 9,080                   | 628              | 9,400                   | 620              | 10,210                  | 573              | 10,360                  | 584              |

The United States Conservation Commission reported that eighty-five per cent of typhoid fever and eighty per cent of malaria are preventable. If that is so, more than 41,304 (perhaps 80,000) persons in the past five years have had malaria or typhoid in California needlessly, and 3,099, who should be active workers in our industries and activities, are filling unnecessary graves.

It will be noted in the California deaths given above that malaria has remained nearly stationary in annual number during the past five years, while typhoid fever has decreased approximately twenty per cent. This reduction has in large measure been due to the sanitary engineer. Just as the armies of the world have been slow to recognize the importance of giving the ranking medical officer equipment, men, and authority over all sanitary and medical matters, so the public has been slow to realize that the great scientific truths of preventive medicine can only be successfully applied by specially trained officers who have equipment, authority, and the active coöperation of the citizens. The last ten years have witnessed an awakening in this regard which has been unprecedented. Japan's remarkable demonstration of medical and sanitary science, applied to military requirements, has been paralleled by the United States' application of these same scientific principles to civil populations under military rule in Panama and the Philippines. Isolated states and cities have in recent years made great strides toward demonstrating that civil populations under civil rule may also yield equally remarkable results. The sanitary engineer has perceived what might be accomplished by properly fortifying our cities against the entrance of water-borne diseases through water supplies, and their escape through sewage. He has demanded that cities provide him with sufficient funds to build filtration plants and sewage disposal works, and to employ trained superintendents to control them when built. Cholera has found itself repulsed by these defenses; typhoid has been cut off from its chief method of attacking cities, but being more resourceful than the cholera "germ," continues its warfare through milk supplies and by other means; malaria, being a mosquito-borne parasite, has its

\* These estimates are based upon a case-mortality of ten per cent in typhoid fever and two per cent in malaria. In California the case-mortality is probably always less than this. In the severe Palo Alto milk epidemic of 1903 there were 236 cases, with only five per cent resulting in death. This ratio would indicate upwards of 10,000 cases of typhoid per year to give the known number of typhoid deaths. Malaria, too, is less deadly in California than in many parts of the United States. There are probably nearer 10,000 than 5,000 cases of malaria each year.

activity limited by water and sewage facilities only in so far as breeding places for mosquitoes are eliminated by the better drainage afforded.

Engineers and physicians alike have frequently undertaken, in connection with sanitation or public health problems, duties for which they were not qualified. In the past these duties have largely been undertaken at the urgent request of a penny-wise public, which understood neither the value to themselves of good service nor the damage through failure to the cause of preventive medicine. The popular conception, however, of the possibilities of health conservation has now advanced to a point where demand is made for competent engineers and physicians, specially trained in the biological and social principles underlying successful warfare against disease; and this necessitates the recognition by engineering and medical men of two distinct divisions of their professions—the division of sanitary engineering, and the division of preventive medicine. The training of the civil or hydraulic engineer and of the general practitioner of medicine is no longer adequate to meet the demands of the health conservation movement. This has been partially recognized in sanitary engineering works; it is on the eve of recognition in public health administration.

To those pioneers in engineering who have had the courage and patience to turn aside from the lucrative practice of their profession to master the related principles of biology, physics, and chemistry essential to the successful solution of sanitary problems, too much credit can not be given. They have made possible the construction of the outer defenses about our large units of population, within which health officials may organize for successful resistance. California cities are rapidly providing themselves with water purification, sewage and garbage disposal plants. Competent engineering advice has not always been sought, and some municipal heartaches have resulted; but the need for the sanitary engineer in public health work has been established.

The articles printed in this number of the Bulletin have been written in non-technical language, and are intended to give the interested citizen a knowledge of the factors entering into the proper solution of the sewage disposal problem in any community of which he may be a resident. It is vitally important to California in these early years of the wonderful development which the next fifty years will bring, that her cities build wisely with due regard to our knowledge of sanitary science, and that her rural and mountain communities guard zealously the purity of her streams. How wisely these things may be done remains to be seen, but the adoption of a broad policy of public health administration, in which the health officer, the sanitary engineer, and the citizen each has his part, will insure a large measure of success.

The 1911 Legislature has been particularly interested in the consideration of conservation measures. Health conservation has shared in this interest. Several bills of far-reaching importance to protection of our streams from pollution and to the establishment of adequate sewage disposal systems have passed both branches of the Legislature, and are now awaiting action by the Governor. The "mosquito" bill likewise has gone to the Governor. This bill will do more than bring the sanitary engineer to the aid of the health officer in fighting malaria. By establishing permanent systems of surface drainage in the mosquito-

infested sections of the State, it will greatly aid in the battle against typhoid fever, amœbic dysentery, and other water-borne diseases which are attempting to gain a foothold in the State. A bill establishing the positions of engineer-inspector and sanitary chemist is under consideration. The purpose of adding these officers to the staff of the State Board of Health is to give effect to the stream pollution laws, and to aid counties, cities and individuals to understand the engineering phases of their public health problems. The State is well supplied with competent practicing sanitary engineers, and once the people have been helped to thoroughly understand their sanitary needs, they will not fail to avail themselves of the services of experts in providing for these needs.

California may be expected to redouble her progress in health conservation work during the next two years.

## **A REVIEW OF SOME AVAILABLE METHODS OF SEWAGE TREATMENT FOR CALIFORNIA.**

By CHARLES GILMAN HYDE, Sanitary and Hydraulic Engineer.\*

### PRELIMINARY CONSIDERATIONS.

#### *Foreword.*

The sewage treatment problem is by no means a simple one. The purification of domestic wastes only, offers the least difficulty; the treatment of mixed wastes (domestic, trade, and street) may occasionally present features of utmost difficulty. Each case is more or less completely a law unto itself. It is folly to suppose, as is so often done, that because town X can dispose of its sewage successfully in some certain fashion, town Y can adopt the same method with a certainty of securing equally satisfactory results. As will be shown forthwith, sewages differ widely in character and composition, not only as between towns, but in a given town as between seasons, days of the week and even hours of the day. The only rational method of attacking the sewage treatment problem for a community wherein sewers are already in operation is to carefully determine the regimen of sewage flow by measurement and its character by analytical methods. For towns projecting sewerage and sewage disposal works comparisons must be made with other towns having quite similar conditions. There can be no question but that specially trained and experienced sanitary engineers are needed for the design of the more refined and effective works for sewage treatment. The whole subject of sewage disposal is worthy of and demands careful study.

With the exception of a comparatively few places where sewage farming or broad irrigation of sewage has been introduced, almost the only type of sewage purification works to be found in California to-day are septic tanks, so-called, fully "fifty-seven varieties" in all, differing as to shape, relative size, etc. Many of these are operating very indifferently well and some very badly indeed. The general situation shows plainly the need of expert advice to municipalities with respect to general methods and necessary efficiencies from some central advisory authority. To every student of this matter it is clear that this body

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should be the State Board of Health, which should be furnished with ample funds to develop and maintain a corps of trained and capable sanitary engineers. This has been done with the greatest success and efficiency in Massachusetts for more than twenty years, in Ohio for ten years, and in other states, such as New York and Pennsylvania, during shorter periods of time.

*Purpose of article.*

It is the purpose of the present article to outline in brief and untechnical terms some of the most available rational processes of sewage treatment adapted and adaptable to California conditions. It is especially hoped to show that there are available processes of treatment of sewage other than by the septic tank, which has been very much over-exploited in this section. Features of design and construction, being peculiarly engineering problems, will not be discussed in detail.

*Character and composition of sewage.*

A fundamental characteristic of sewage, and one which bears immediately upon the sewage treatment problem, is that it consists of two very definite and distinct parts, namely, a conveying liquid and suspended solids. Sewage is the water supply of the community—except that portion which is used on lawns, gardens, etc., and which does not reach the sewers—conveying fecal, bath, kitchen, laundry, industrial, street, and other wastes. The conveying liquid is usually rich in dissolved organic matter, most of which is readily decomposable or putrescible and extremely high in its content of bacteria. The sludge is more resistant in composition, but extremely rich in organic matter, very putrescible and high in its content of bacteria. At the usual velocities obtaining in sewers the solids are kept in suspension, but when the velocity is checked and reduced to a very slow forward motion, as in precipitation basins, septic tanks, etc., these suspended solids tend to settle from the sewage, forming a sludge, and leaving a supernatant, milky, fairly turbid liquid. In this liquid are colloidal substances, on the border-line between solution and suspension, which will not settle until changed in character.

Messrs. Kinnicutt, Winslow, and Pratt have very clearly exhibited in tabular form the general character of the sewage of an American residential town as respects solid matter, as follows:

|  |  |  |
|--|--|--|
| Solid matter,<br>200-800 parts<br>per million. | Inoffensive, mineral, 50 per cent            | { In solution, 75 per cent.<br>In suspension, 25 per cent.       |
|  | Offensive, vegetable and animal, 50 per cent | { In solution, 60<br>per cent.<br>In suspension,<br>40 per cent. |

All sewages are very unstable, and their composition at any time is determined not merely by the character of the initial fresh, raw product, but also by the extent of the changes which have been wrought therein, mainly by the action of bacteria but partly by chemical action. Due to these changes, which arise or set about as soon as sewage is received into the sewers, it is to be remembered that the distance and rate of travel may become important factors determining the state of a sewage

when it arrives at the disposal works and defining the optimum period of storage in septic tanks, etc.

The character of a municipal sewage varies with the habits of the people as respects the use and waste of water, with climatic conditions, with the amount and character of trade and industrial wastes, with the infiltration of ground-water, etc. In some communities the wastes from a single large industry, such as a creamery, tannery, brewery, straw-board factory, wool scouring shop, dyeing and cleaning works, etc., may, during certain hours of the day, predominate over all other wastes, changing the character of the sewage very materially. It must be clear, from a consideration of the action and inter-action of these principal governing factors, that the character of sewage must be very different in different communities, and in a given community at different seasons of the year, different days of the week, and even different times during the day. A recognition and determination of these differences is essential to success in a sewage treatment problem. The analytical determination of the character of sewages requires training, experience and equipment. Such work should be done by the State Board of Health for all communities—at any rate, for all towns and cities except, perhaps, the largest, which may happen to be provided with their own properly equipped laboratories and trained analysts. It is a striking fact that practically no sewage analyses have been made in California, and virtually nothing is known with respect to the character and composition of the sewages of our municipalities or of the sanitary efficiency of our treatment works.

#### *Disposal by dilution.*

Except for those cities and towns situated upon the coast or upon great tidal bodies of water, such as San Francisco Bay, the opportunity for disposal of sewage by dilution is generally lacking in California. Few of our river systems, except perhaps the Sacramento and San Joaquin rivers, yield a sufficiently large and constant discharge to permit of disposing any considerable quantities of sewage therein without creating a nuisance. Experience elsewhere has demonstrated rather definitely that a nuisance will surely be caused if sewage is diluted with less than about twenty volumes of water, while from forty to fifty volumes may in some cases be necessary to certainly prevent a nuisance. Of course, these values refer to low flow, if not to minimum flow, conditions in streams. In the January issue of the Bulletin, Mr. Griswold has discussed the action of self-purification in streams and has presented an outline of the conditions which determine the extent and efficiency of this action. The conditions which may define the term "nuisance" in connection with river pollution are: The formation of deposits of sludge on the banks and in the beds of the streams; the production of turbidity, milkiness, oiliness and discoloration of the water; the formation of gases of decomposition, principally sulphuretted hydrogen, causing very bad odors; the formation from sludge of masses of scum which float upon the water, due to the bubbles of gas contained; the destruction of fish, etc.

But the problem of disposal by dilution is far broader than the mere question of whether, on the one hand, a nuisance will be caused or, on the other, the self-purifying power of the stream will be sufficient to

maintain its sightliness and æsthetic character. Of far greater importance are the questions of adaptability to water supply and industrial purposes, the promotion and conservation of the health of residents in the vicinity, and the possibility of indulging in water sports, etc., without undue danger. The rivers of California are of priceless value to the State and its people and should not be made to serve as sewers for the removal of the wastes of an ever-increasing population.

The laws of the State of California with respect to the control of the purity of inland waters are very sweeping. They represent the ideal to which the future must, if possible, attain. At the present time the State Board of Health does not have the authority, the machinery or the funds required to put these laws into effect, or to even undertake a systematic program looking to ultimate control.\*

With respect to the taking of water supplies from streams into which sewage or sewage effluents find their way, a careful review of the situation by sanitary engineers has led to the following fairly well-crystallized conclusions:

(1) No surface waters receiving sewage or the effluents of sewage treatment works are suitable for water supply purposes without purification.

(2) The discharge of crude or of partially purified effluents into such streams must at all points be well below the limit within which self-purification can readily be accomplished.

(3) All supplies of water derived from sewage polluted streams must be purified in accordance with methods adapted to the particular conditions of the stream in question.

#### *Required degree of sewage purification.*

From the preceding discussion it will be seen that the required degree of purification, or, in other words, the efficiency of the removal of the polluting matters in sewage, must be determined in any given case from considerations of the amount and character of the sewage, the regimen of the stream, the self-purifying capacity of the stream, the utilization of the stream for water supply purposes, etc. Different methods of sewage treatment naturally yield different efficiencies, and certain methods of treatment may be modified and adjusted to yield different degrees of purification according to requirements.

#### METHODS OF TREATMENT.

##### *General classification.*

The various available known methods of sewage treatment may be classed in three distinct and important groups, as follows:

(a) Those which remove more or less of the solids, especially the suspended matters, but from which the effluent is chemically unstable and capable of further decomposition and putrefactive changes. Methods in this class may be called "preliminary" or "preparatory."

(b) Those which remove a substantial proportion of the dissolved and suspended mineral and organic matter and which produce an effluent of fairly stable composition requiring only a moderate degree of further oxidation to render wholly stable. These methods may be called "final."

(c) Those which destroy the bacteria, especially the pathogenic or disease-producing bacteria, but which in themselves do not effect any material change in the physical or chemical character of the sewage. These methods may be called "disinfection" methods.

When class (b) methods are used, it has recently been customary to provide some preliminary treatment in accordance with one or more of the methods in class (a). In important cases, especially during the

\* The present Legislature is now considering bills which are designed to remedy these defects.

prevalence of epidemics of intestinal diseases, class (c) methods may be applied to supplement the work of either or both class (a) and (b) methods.

(a) *“Preliminary” methods of treatment.*

The various preliminary or preparatory methods of treatment in vogue to-day, named in order of their general efficiency, from the least to the greatest, in the removal of suspended matters, are as follows:

- (1) Screening.
- (2) Grit removal.
- (3) Plain sedimentation.
- (4) Straining or roughing.
- (5) Chemical precipitation.
- (6) Septic tank processes { In Cameron type septic tanks.  
In Emscher type septic tanks.
- (7) Contact beds—single.

(b) *“Final” methods of treatment.*

The various methods of treatment which ordinarily do or may produce effluents of such a stable character as to entitle them to be classed as “final” methods are the following, named in the order of efficiency of removal of organic matter from the least to the greatest:

- (8) Contact beds—double.
- (9) Trickling, percolating or sprinkling filters.
- (10) Intermittent filtration through sand.
- (11) Broad irrigation or sewage farming.

(c) *Disinfection of sewage.*

The particular method of disinfection of sewage and sewage filter effluents which is in use to-day in the United States is the following:

- (12) Hypochlorite (bleaching powder) disinfection.

(1) *Screening.*

The object of screening is the removal of the coarser suspended matters in sewage. The modern tendency is toward the use of constantly finer screens, mechanically operated. Screens have always been considered of value in connection with sewage pumping works and inverted syphons. More recently it has been discovered that screening may be of substantial advantage in cases where otherwise untreated sewage is disposed of by diluting in water, or where otherwise unprepared sewage is to be applied directly to a final process such as contact beds, percolating filters, intermittent sand filters or sewage farms. They may even be of advantage in connection with the septic process because of the removal thereby of considerable volumes of light materials which might otherwise float on the surface and unduly increase the amount of scum.

The efficiency of the process depends entirely upon the size of mesh or openings through which the sewage is passed. With ordinary hand-cleaned bar screens from 2 to 10 per cent of suspended matter is removed; mechanically operated self-cleaning sieves may remove as much as from 20 to 25 per cent of the suspended matters. The volume of material removed by bar screens from American sewages is from 2.5 to 6.0 cubic feet per million gallons, while with mechanical sieves this quantity may be from 20 to 40 cubic feet. The amount of moisture contained in the screenings from the finer sieves is greater than in material removed by bar screens.

(2) *Grit removal.*

Grit chambers are designed with a view to remove from sewage the coarser suspended mineral matter which settles rapidly, due to its high specific gravity and mass, and such matters only. These materials should be found only in combined sewages which receive street wastes. In Europe the silt and other coarse materials removable by grit chambers or basins are known as "road detritus." Grit chambers are usually unnecessary in works treating domestic sewage. In the treatment of combined sewages they are of value as preliminary to disposal by dilution and as precedent to subsidence of all types, plain, coagulated, and septic.

Grit chambers should be sufficiently large to intercept the heavy mineral matter and yet so small that no significant proportion of organic matter will be deposited. The capacity should as a rule be such that a net period of storage of at least three minutes is allowed, but the forward velocity should not be less than 5 feet per minute.

In some cases where grit chambers have been constructed in California in connection with septic tanks, they have been made so large that violent septic action, accompanied with excessive scum formation, takes place in them. This is, of course, very undesirable. It is apparent that if grit chambers are needed they should be carefully proportioned and arranged in multiple units, both for purposes of cleaning and with a view to maintain a more or less definite period of subsidence notwithstanding changes in rate of sewage flow.

(3) *Plain sedimentation.*

By means of plain subsidence in properly designed basins it has been attempted at various places in America and Europe to remove from the sewage the suspended materials or sludge, which have been shown to be a most troublesome element in sewage purification. In practice the period of storage in such tanks varies considerably. The earlier plants were constructed on what is known as the fill and draw principle, but most of the later plants are operated on what is known as the continuous flow principle. In the latter type from six to twelve hours probably represents the range in storage period for American sewages. In properly designed basins of this type from 50 to 75 per cent of the suspended matters may be removed and deposited as sludge at the bottom. The remaining 25 to 50 per cent will ordinarily not settle from the sewage in a very extended period, and therefore the prolongation of the period of storage beyond, say, twelve hours is economically inadvisable. The volume of sludge accumulating in American tanks seems to be from 4 to 6 cubic yards per million gallons of sewage treated. This process, while relieving the sewage of a substantial proportion of suspended solids, nevertheless affords in itself no method of disposal of the sludge as does, in a degree, the septic process. The sludge must be removed from the tanks at frequent intervals and must be separately treated. Under the conditions where plain subsidence would be used, it is evident that the sludge can not be disposed of in currents of water because if this were a possibility the crude sewage could be disposed of in the same manner without treatment.

Reviewing California conditions, the writer believes that there are but

few situations where plain subsidence can be satisfactorily utilized as a process of sewage treatment. These would seem to be—

(1) In connection with disposal by dilution in tidal bodies capable of receiving the settled sewage without producing a nuisance, and where the sludge can be taken to sea in vessels, as at Manchester and London, England.

(2) In connection with intermittent sand filtration and sewage farming where areas of fairly coarse material, suitable for sludge beds, are available.

(4) *Sewage straining or roughing.*

Only a few examples of roughing filters for sewage exist in this country or Europe. When provided it is with the object, of course, of removing the suspended matters by means of rapid straining. This is done either through beds of coke or through sand beds in filters constructed like the rapid sand or mechanical water filter. Coke beds have not proved successful in actual practice, especially in cold climates. Rapid sand filters produce a volume of wash water, highly charged with the organic or mineral impurities of the sewage, which may amount to from 3 to 10 per cent of the filtrate. Such wash water requires special treatment which is ordinarily very difficult and expensive. No coagulant is used in connection with such straining filters. The process is an expensive one at the best, both as respects construction and operation. The effluent from such works can be made fully equal to, if not better than, the effluent of plain sedimentation basins, from a sanitary point of view. It is believed that this is not an available process under most California conditions.

(5) *Chemical precipitation.*

The subsidence in basins of suspended solids, by the use of coagulants of various kinds, was an exceedingly popular method of sewage treatment during a period of some twenty to thirty years prior to the introduction of the so-called biological process about twelve years ago. A very large number of plants were constructed in England during this time, and a few plants were built in America. By the use of chemicals it was attempted to produce at least a clear effluent, free from suspended matters. This was quite possible, but the sludge problem was rendered even more difficult to handle, and the effluent, while clearer, was scarcely less putrescible than that resulting from plain subsidence. The amount of sludge created by this process is ordinarily fully fifty per cent greater than with plain subsidence. The efficiency of the removal of suspended matters has usually ranged from sixty to ninety-five per cent. This process is primarily available in California only under the conditions first stated above as the field of application of plain subsidence, namely, in connection with disposal by dilution in situations where the sludge can be taken to sea in vessels.

(6) *The septic process.*

(a) *Cameron type septic tanks.*—The characteristic processes involved in the action of septic tanks are not at all different from those which have for a long time been relied upon in connection with the disposal of sewage in leaching cesspools, though perhaps without recognition and study until the development of the septic tank called attention to them and offered an explanation for the well-known fact that the sludge from domestic wastes accumulated very slowly, if at all, in such chambers. As a definite treatment, adapted to municipal sewages,

the septic process dates back some sixteen years. It was then exploited by Donald Cameron of Exeter, England, who achieved remarkable success in the anaerobic (decomposition) treatment of a portion of the sewage of that city. In his experimental tanks the sludge accumulated very slowly and was so thoroughly changed in composition, due to the long continued action of the bacteria (and other organisms), that it became like humus, and in one year amounted to perhaps one fifth, only, of the solids deposited in the tank. The effluent contained about seventy per cent of the organic matter in the raw sewage. These results were so remarkable as to attract the widest attention, and similar experiments were inaugurated in many different places with corresponding success. On the basis of these studies the septic process was adopted for the treatment of municipal sewage with almost hysterical enthusiasm, not only in England, but on the continent of Europe and in America. In America, especially, the septic tank wave rolled from the Atlantic to the Pacific seaboard, leaving in its wake a huge number and variety of septic tanks. Some of these, well designed and adapted to local conditions, have achieved all that could reasonably be expected of them, but many others have absolutely failed to perform the work which early experiments would indicate as possible. Failures have been due to a variety of causes, perhaps more than any others to ill adaptation to the specific conditions met with in specific cases, and to a general ignorance of the true principles involved in anaerobic sewage treatment. That the process during the past ten years has been over-exploited and that its general efficiency has been greatly exaggerated is apparent to-day when, in view of many failures, an actual distrust of the process has been brought about. The statement has been widely circulated among laymen that the effluent of septic tanks is quite suitable for drinking purposes, all of the impurities of the sewage being removed thereby. During the past few years the writer has received many inquiries regarding the truth of this statement.

The septic tank process is primarily aimed at the removal of sludge. It is by no means a final process, inasmuch as the effluent is almost invariably somewhat turbid, always extremely putrescible and rich in unstable dissolved organic matter.

A review of the principles and results of operation of the septic tank of the Cameron type would appear to justify the following more important conclusions:

(1) The average removal of suspended solids from the raw sewage by the most successful tanks may vary between thirty-five and eighty-five per cent, averaging perhaps fifty to sixty per cent. At times of active gas formation the septic effluent may contain a larger amount of suspended matter than the entering sewage. As the sludge accumulates in the tank the condition of the effluent, as respects turbidity and suspended matter, is apt to gradually become less satisfactory.

(2) In some tanks the gassification and liquefaction of sludge almost keeps pace with the rate of accumulation, so that a period of several years may elapse between enforced cleanings. In many other cases the tanks require frequent cleaning, say from two to twelve times per year. The volume of sludge digested, *i. e.*, liquefied and gassified, would seem to ordinarily vary between ten and sixty per cent. The average value is certainly not over forty per cent. Septic sludge is normally less offensive than the sludge from plain sedimentation or chemical precipitation tanks.

(3) The period of storage in septic tanks must be carefully adjusted to conditions. Weak sewages seem to require a shorter storage period than strong sewages. Moreover, the condition of the sewage, whether fresh or comparatively stale when delivered to the tank, is a controlling factor. The gross capacities

of the tanks which have been apparently well designed and which have operated with more or less success have been equivalent to from eight to forty-eight hours of sewage flow. As a rule, the period should not be greater than twenty-four hours nor less than twelve hours, except possibly with weak or stale sewages. Multiple units are very desirable in order that the storage period may be controlled to give optimum results.

(4) As compared with fresh settled sewage the septic effluent, especially that resulting from a too-long storage in the tank, is probably more difficult to oxidize in final processes of sewage treatment, such as the trickling filter, contact bed, intermittent sand filter or sewage farm.

(5) The septic process does not seem to afford an efficient means of destruction of pathogenic bacteria. Recent investigations would seem to permit of the conclusion that septic effluents are only less dangerous than crude sewage to the extent of the efficiency of removal of organic matter.

(6) The climatic conditions in California are especially favorable to the septic process and, in fact, to all biological processes of sewage treatment.

It must be recognized that the septic tank, like other engineering works of this nature, can not be a standardized apparatus. It is one which must be carefully proportioned, designed and adapted to the governing conditions of each case. Probably special consideration must be given to details of design in those sections of the State where very high summer temperatures prevail. Matters of design are beyond the scope of this paper.

Federal patents on the septic tank process have been granted to the Cameron Septic Tank Company, and all cities, towns, and institutions in the United States which have constructed septic tanks have been warned of infringement and threatened with suits. The status of this litigation is so familiar to the people of California that further reference to this subject is considered unnecessary here.\*

(b) *Emscher type tanks*.—In recent years very many investigations and experiments, looking to a more successful solution of the sludge problem than is offered by the septic tank, have been under way. In consequence, various schools of workers, holding different views of the problem, have developed. Some of these schools believe that successful sewage treatment is primarily a physical process involving sedimentation and surface contact, while others hold that the biochemical actions are of extreme, if not of fundamental, importance. As a matter of fact, there is truth in both points of view; and it is to be expected that in the future the relative value of sedimentation and surface contact, of bacterial action, and of the activities of larger organisms, such as worms, arachnida, etc., will become manifest.

Aside from its lack of efficiency in many cases, objections to the Cameron type septic tank have been raised on the ground that the effluent is too stale and difficult to treat by oxidation processes, that the odor is frequently obnoxious, and that the sludge is not thoroughly digested and is sometimes quite offensive, although, as stated above, not generally so offensive as that from plain and coagulated subsidence.

During the past two or three years there has been developed in the Emscher Valley, in Germany, a type of tank which seems to overcome most, if not all, of the principal objections to the Cameron type of septic tank. This process was suggested by Dr. Imhoff, and has been strongly advocated by the Emscher Drainage Board. The tank is variously known as the Emscher, Ems, Essen, and Imhoff tank.

In brief, the process consists in passing the sewage at a low velocity through comparatively shallow V-shaped tanks, or chambers, whose sides

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\* The full details of this litigation in California has been previously published in the March, 1910, number of this Bulletin.

are sufficiently steep so that the deposited solids settle to the bottom of the V, where they pass through suitably arranged slots into a deep chamber below. The period of storage of the main bulk of the sewage is comparatively brief, say three or four hours. This period is so short that septic action does not become established, yet the rate of travel is sufficiently slow so that a substantial proportion of the suspended matter is deposited. The sewage may then be passed to other treatment devices or to points of discharge in water courses, as the case may be. It will be seen that the sewage does not have a chance to become stale, nor does it come in contact with decomposing sludge.

In the lower tank, into which the sludge settles through the slots above referred to, a slow digestion takes place through septic and other action. At frequent intervals portions of the thoroughly digested sludge are drawn off from the bottom of the tank by special piping arrangements and fresher sludge takes its place. The sludge, thoroughly rotted by the action of the bacteria, worms, etc., is no longer sticky and greasy, but humus-like. Due to the downward motion of the sludge, caused by drawing off small quantities at frequent intervals, any toxins which may be produced locally by bacterial action, and which would tend to inhibit such action, are apparently distributed and diffused so that bacterial activity is maintained and the maximum amount of solids is liquefied or gassified. The gas is taken from the top of the lower tank through specially arranged pipes. The sludge is either discharged upon special sludge beds of coarse material, where in favorable weather it drains quickly and soon reaches a state permitting of easy removal, or it may be buried in trenches in agricultural land.

The efficiency of this process under American conditions can only be inferred from certain experimental results. The results obtained at Philadelphia during one year of operation of experimental tanks have been very satisfactory. Tanks of this type have been recommended by Messrs. Hering and Fuller of New York City, and are about to be installed for the treatment of the sewage of Atlanta, Ga.

The California climate would undoubtedly be very favorable to this process. In general, this method of treatment promises well, and should be investigated under local conditions. In a short while considerable data for American sewages will be available. It is evident that the proportioning of these tanks, both with relation to the period of storage of the sewage to effect a deposition of the solids and of the sludge to bring about thorough digestion, is a matter of great importance and must be worked out for various climatic conditions as well as different sewages.

The septic process, as carried out either in the Cameron type or in the Emscher type of tank, but especially in the latter, has at present two distinct fields of usefulness: first, it constitutes an effective means of preparation for any final process which can be better conducted with a sewage from which the suspended solids are more or less completely removed; second, it may be employed where disposal by dilution is permissible if the source of unsightly sludge and scum is removed.

(7) *Contact beds, single.*

All of the methods or processes of treatment which have been previously discussed have been aimed primarily at the separation from the sewage of the suspended matters, from the coarsest to the very finely

divided. Only secondarily have chemical changes been intentionally brought about. In contact beds, however, we have a process which not only removes or changes the character of the suspended solids, but which purifies the sewage by biochemical action. The action is both anaerobic (liquefying and gassing) and aerobic (oxidizing), principally the latter. The process, in its physical, chemical and biological actions, is exceedingly complex, although the works required for carrying it out are extremely simple.

Briefly stated, a contact bed comprises a water-tight basin from three to four feet in depth, filled with some hard and fairly durable granular material of a uniform size suited to the particular requirements of a given case, or with horizontal layers of slates or slabs laid about two inches apart. Contact beds must be thoroughly underdrained and the distribution of sewage over the surface must be such as to prevent local clogging.

As usually operated, the beds are filled with sewage in from one to two hours, are kept full of sewage from two to three hours, are emptied in from one to two hours, and remain empty for from four to six hours. Of course, deviations from this general regimen are frequent. The rate of operation of single contact beds is generally equivalent to not less than 600,000 gallons per acre per day, and is seldom greater than 1,000,000 gallons. The loss of head is seldom less than four feet nor more than six feet with beds of the depths stated above.

Single contact, *i. e.*, the use of a single set of contact beds, does not usually produce a stable effluent and, therefore, is to be regarded as a preliminary process in accordance with the distinction adopted for the purposes of the present discussion. The purification which may be expected from single contact, as measured by the removal of suspended solids, may vary between sixty and seventy-five per cent, and as measured by the removal of organic matter between fifty and sixty per cent.

Single contact is seldom employed as a preparatory treatment; it is occasionally employed in conjunction with septic tanks or other preparatory treatments as a final process. Such plants are in operation at Plainfield, N. J., and Mansfield, Ohio, and are said to be giving satisfactory results. California climatic conditions are favorable to this process, and there are doubtless some circumstances under which it can be used to advantage. As a general statement, it may be said that the septic process, perhaps especially as conducted in the Emscher tank, is cheaper and gives an almost equally effective preparatory treatment, yielding a greatly improved but putrescible effluent. Although sometimes employed as a final method of treatment, as stated above, it does not appear that contact beds have a great field of usefulness for this purpose. As respects the destruction of pathogenic bacteria, it is believed that contact beds are not more efficient than other processes giving the same efficiency in the removal of organic matter.

(8) *Contact beds, double.*

Double contact implies the operation of two sets of contact beds arranged in tandem. As a rule, the material in the beds utilized for the second contact is considerably finer than in the first. The process is capable of yielding a non-putrescible effluent, low in suspended matters

though somewhat discolored, and one which can be discharged without offense into very small streams. The net rate of operation, referred to the total superficial area of both sets of beds, is seldom greater than 500,000 gallons per acre per day nor less than 300,000 gallons. The process is not as flexible as to rates of operation as are certain others to be later described. A head of from six to ten feet is normally required for this process. The total efficiency, as measured by the removal of suspended solids, has been found to vary from eighty to nearly one hundred per cent; as measured by the removal of organic matter, the efficiency usually ranges between seventy and eighty-five per cent. One very unfavorable feature of contact beds is that they gradually become clogged with resistant organic and mineral matter, so that removal and cleaning of the filling material are required. This is, of course, expensive and is especially undesirable where labor costs are high.

Climatic conditions in California are favorable to this process. It is capable of treating crude sewage, especially that from which the coarser suspended matters have been removed by effective screening. As compared with intermittent sand filters or sewage farming, from the standpoint of efficiency, the process yields distinctly inferior results. As compared with percolating or trickling beds, contact beds are less compact and are more costly. They are, however, less conspicuous, the odor attending the process is less pronounced and they do not breed flies as trickling filters are reported to do. This process may have a field of usefulness in special cases under California conditions.

(9) *Trickling, percolating, or sprinkling filters or beds.*

Trickling or percolating filters have been gradually evolved through experiments conducted during the past twenty years. For ten years the process has been in practical operation and for four or five years the mode of action has been fairly well understood, and the process has been a demonstrated success under conditions to which it is adapted and where the works have been properly designed. These filters consist essentially of beds of coarse-grained, durable material resting upon some efficient system of under-drains in or on an impervious floor. If above ground, the beds may be surrounded by walls of concrete, by open brick work or by banked-up filling material; if in excavation, the side walls may be vertical, of concrete, brick or stone, or sloped at the angle of repose of earth and paved or concreted. The size of material, the depth of bed and the rate of operation are all inter-dependent factors and all relate closely to the strength and character of the sewage. It is of fundamental importance that the sewage be sprinkled or deposited on the surface of the beds in thin, thoroughly aerated films. In practice, the depth of bed generally ranges between 4 and 6 feet, the size of material from  $\frac{1}{8}$  of an inch to  $\frac{1}{2}$  of an inch, to  $1\frac{1}{4}$  inch to 4 inches, and the rate of operation from perhaps 1.0 to 2.5 million gallons per acre. The loss of head is rarely less than 8 feet, and it may be considerably more. It is to be observed that these rates of operation are far in excess of any that can be obtained with other final processes of sewage treatment, especially with intermittent sand filters and broad irrigation. Generally speaking, the best results are not secured with the application

of crude sewage unless it is especially weak and has been thoroughly screened, but rather with sewages from which a substantial percentage of suspended matter has been removed by preparatory treatment.

This process is wholly one of oxidation, in which absorption, bacterial action and the activities of larger organisms all play a conspicuous part. The effluent of properly designed and operated works is non-putrescible or stable in character, and may be discharged into the smallest streams. The effluent is not clear, but contains humus-like particles, which settle rapidly and which in weight are practically equivalent to the weight of solids applied to the filter. In other words, the trickling bed does not accumulate solids as does the contact bed. As measured by the reduction of organic matter, the general efficiency of the process has ranged in England between eighty and ninety-five per cent. In the United States a much lower efficiency has been obtained, both in experimental and in large municipal plants. Nevertheless, the effluent in all cases has generally been stable and thoroughly suitable, after the settlement of suspended matters, to discharge into streams. In respect to the removal of organic matter, this process shows decided superiority over the double contact process.

In California the conditions are generally ideal for this process. It should have a wide field of usefulness, wherever compact plants must be erected to operate at comparatively high rates in more or less thickly settled districts, where sufficient head is available by gravity or pumping and where land would not be available or the conditions right for broad irrigation or sewage farming.

(10) *Intermittent sand filtration.*

Intermittent sand filtration is by far the best known and most thoroughly studied process of sewage treatment in America. For more than twenty years it has been constantly under investigation by the Massachusetts State Board of Health, both in experimental plants and in municipal plants, on a large scale. Many sewage purification plants of this type are in operation in Massachusetts, Ohio, and other states where suitable materials are naturally available. The process is one of nitrification or oxidation, and seems, in a general way, to epitomize the natural purification which the soil effects of all impurities deposited in a film thereon. As usually carried out, areas of suitably porous soil are selected and the top soil is removed and placed in embankments between beds, making these of a size best adapted to the rate of sewage flow. These beds are under-drained with tiles if the water-table is not naturally low. Where suitable material is not found *in situ*, the beds may be constructed of especially selected and deposited materials, but such construction, of course, increases the cost greatly. In operation, the sewage is applied in rotation rapidly to each bed until each is completely covered to a slight depth. The bed is then allowed to drain slowly and to rest for some time thereafter. Meanwhile other beds are being dosed, drained and allowed to rest. These filters are very sensitive to long-continued overdosing and to lack of aeration, and will not prove efficient if not carefully dosed, cleaned and rested. A great deal of information is available with reference to these matters, and it is considered entirely unnecessary to refer in detail to them here.

If conducted in suitable soils at proper rates very high efficiency may be obtained with intermittent sand filters. At one plant, at least, in the United States, that at Spencer, Massachusetts, the filter attendant regularly uses the effluent as a drinking water supply. The bacterial purification should be fully 99 per cent under favorable conditions. The removal of organic matter should be fully 95 per cent. The effluent is usually of excellent appearance and free from disagreeable odors. The rate of operation varies very widely, according to the character of applied sewage, the porosity of the soil, the temperature conditions, etc. In general, the rate varies between 40,000 and 100,000 gallons per acre per day. Higher rates may be employed with effluents of efficient preparatory treatment works.

It is not probable that this method of treatment will ever find wide application in California, although here, as for other biological processes, the climate is quite ideal, even in the most elevated districts where such plants would in all likelihood be built. Where gravelly or sandy deposits are to be found and where broad irrigation can not be conveniently resorted to, as for small isolated institutions, hotels, summer resorts, camps, etc., this method of purification could be very advantageously employed. Throughout our mountainous districts are many resorts where this method of treatment could be very easily adopted, thereby protecting in an efficient manner the streams which are now being polluted by these sources.

(11) *Broad irrigation or sewage farming.*

In the process of treatment known as broad irrigation or sewage farming the sewage is utilized for the growth of crops in very much the same manner that water would be. The sewage has, however, some slight fertilizing value. In principle this method is not essentially different from intermittent sand filtration, but it is usually conducted at rates from one tenth to one twentieth as great as those employed with intermittent sand filters. It is possible to dispose of sewage by broad irrigation at rates varying from 2,000 to 10,000 gallons per acre per day, depending upon the character of the sewage, the kind of preparatory treatment which it has received and the character of the soil. As with intermittent sand filters, higher rates of dosing and better results are generally to be obtained with sewages from which the suspended matters have been in part removed by some preliminary treatment. Heavy soils are not naturally adapted to this method of sewage treatment, but they can be utilized if sufficient area is provided so that the rate of application shall be suitably low. The efficiency of treatment, measured by the removal of suspended solids, organic matter and bacterial may, under favorable conditions, be very high indeed, perhaps fully as high as with intermittent sand filtration, which yields effluents of greater purity than any other method thus far discussed. In England an extended experience with broad irrigation shows that if the land is naturally unsuited to this treatment, and if the rate of application is too great or the farms improperly manipulated, high efficiencies can not be obtained. In France and Germany very satisfactory results have been obtained on the extremely large sewage farms operating on the sewage from the cities of Paris and Berlin, respectively. Few, if any, data showing the efficiency of sewage farming in the United States are available.

There can be no question but that in an arid or semi-arid district, where soil conditions are suitable and where lands are available, the disposal of sewage by irrigation is the most logical method which can be employed. It would seem to be a criminal waste to discharge sewage into streams or into the ocean when adjacent lands are suffering from lack of moisture. Moreover, the pollution of the streams whose purity would otherwise be preserved is a feature worthy of careful consideration.

In the rainy season it is specially important that sewage farming be carefully conducted, in order that the sewage shall be thoroughly purified and at the same time that the land shall not be super-saturated. It must be impressed upon the municipalities utilizing this method of sewage treatment that sanitary efficiency rather than financial success is to be primarily sought.

In California the sewage of a number of communities is being successfully treated by broad irrigation, both on municipally owned and on privately owned areas. At some places, notably Fresno, considerable competition in securing rights to the use of different quantities of sewage for irrigation has developed on the part of private landholders.

(12) *Disinfection of sewage or effluents from sewage treatment works.*

During the past few years a great deal of attention has been devoted to the problem of the treatment of water and sewage to effect the removal of bacterial contamination, especially contamination by disease germs. Various sterilizing or disinfecting agents have been investigated, with the result that all have been found either too difficult or too costly to apply, with the exception of certain salts of copper and certain chlorine compounds. Of these, for most conditions, the hypochlorite of calcium (bleaching powder) has been found to be cheapest and most efficient, although sodium hypochlorite, electrolytically prepared, may be favorable in very large plants under expert supervision in localities where electric power is very cheap. Carefully conducted experiments at various places have demonstrated clearly that the great bulk of dangerous bacteria can be removed from crude sewage or effluents from sewage treatment works at a very moderate expense, especially for the latter. It is scarcely to be expected that disinfection will be found necessary for effluents from intermittent sand filters or sewage farms, where the bacterial efficiency is already very high. But where effluents from preparatory treatment or rapidly-operated final treatment works, such as contact beds and trickling filters, are discharged into water courses from which water supplies are derived, or into tidal estuaries from which shellfish are being taken for the markets, it appears that disinfection has a distinct field of usefulness. It is apparent that disinfection is especially necessary when epidemics of intestinal, water-borne diseases prevail in any community disposing of its partially purified or crude sewage in streams utilized for water supply purposes.

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## **NOTES ON SEWAGE DISPOSAL.\***

By C. E. GRUNSKY, Dr. Eng., San Francisco.

Last April I visited the sewage disposal works of Wilmersdorf, a suburb of Berlin. These were represented to be an up-to-date arrangement and proved to be well worthy of examination. The day was mild, but cloudy and threatening rain. A moderately strong wind was blowing. On the two-mile walk from the nearest railway station, I crossed the wind's course as it blew from the works. It came heavily laden with malodorous gases, and my conviction was speedy and strong that no matter how clear and nonputrescible the effluent from such clarification works might be, the works would be inadequate to meet the requirements for or near any large American city.

At these works, which are known as "Klar-Anlagen," the sewage is received in a circular concrete tank from which it flows to open settling basins. Of these there are four acting on the principle of the septic tank. They are scum-covered and practically odorless, except when the sludge is removed by being syphoned to nearby sludge beds. The effluent from the settling basins flows to a chamber, the outlet of which remains closed until the chamber is full, whereupon its overflow fills a bucket attached to a lever and opens the flow to the coke beds, of which there are twenty-seven at the works.

Each coke bed is a cylindrical pile of coke with sides practically vertical, about 60 feet in diameter, and about 7 feet high, in the center of which is a riser pipe connecting with two horizontal pipes that extend out to the edge of the coke pile. The horizontal pipes are supported from a central upright extension of the riser pipe by means of iron rods. They are perforated in such a way that the outflow of sewage is proportional to distance from the center toward the periphery of the

\* Read before the Alameda County Medical Society, January 17, 1911, and reprinted with the permission of the Society.

bed, and that this outflow imparts rotary motion to the two arms which swing about a foot above the top of the coke bed, revolving slowly for a few minutes while the bed is being dosed and then remaining at rest until another dose of sewage has accumulated.

The septic sewage thus sprinkled in the open on the coke beds is foul smelling, and there seems to be no way in which septic sewage can be handled at such clarification works, without giving rise to the bad odors that have long been recognized as one of the great drawbacks to any general application of the septic tank treatment of sewage. The effluent from the coke beds is turbid, with an abundance of flocculent matter. It is allowed to flow into another set of four tanks, where most of the material in suspension drops to the bottom, and the outflow is then ready for discharge into the river. This final effluent is by no means perfectly clear. It still carries some flocculent matter. It is non-putrescible and apparently quite up to the standard usually insisted upon in Germany, that it must be at least as free from objectionable matter as the water of the stream into which it is discharged.

The visitor to these works is also shown a field, a few acres in extent, prepared for irrigation, to which the effluent can be led for application to land in case that this final treatment should be thought necessary. The soil being sandy, there is no doubt that it would stand heavy dosing with either the present final effluent or with the effluent direct from the coke beds.

It is hardly necessary to state that the Wilmersdorf "clarification" works are well located, removed from the densely populated areas around Berlin far enough to be not obtrusively offensive. The works stand upon a low, flat-topped hill, and are so arranged that the sewage which reaches the receiving tank flows by gravity to the settling basins, again by gravity to the coke beds, and thence to the sediment basins and to the stream.

The sludge which accumulates in the basins is at intervals of some months drawn from sumps in the bottom thereof by a syphon, and is delivered upon sludge beds which are leveled-off areas of land surrounded by low embankments. The sludge is slow drying, foul smelling, and has some manurial value. It is shoveled into hand cars when dry enough, and there is some demand for it by farmers.

Since noting the above, I have read in the report of Mr. John E. Hill, on the sewage disposal plant at Columbus, Ohio, which is supposed to represent the highest type of American practice, a similar comment with reference to the offensiveness of septic sewage. He examined the septic tanks and sprinkling fillers of the Columbus purification works, and says in his report, published in the annual report of the Chief Engineer of the Board of Estimate and Apportionment for New York City for 1909 (*Engineering News* of December 1, 1910, p. 600):

"While the season of the year and the weather conditions during my visit were unfavorable for the obtainment of the most definite and conclusive results, the thermometer varying between 32 and 71 and the weather being intermittently rainy, still the fact that a strong wind was blowing almost continually was advantageous... I caught the odor from the purification works, suddenly and strong, at a distance of about three quarters of a mile from the works. There was no doubt about the character and offensiveness of this odor. It was characteristic of the septic tank and for the moment was nauseating. For the distance of three eighths of a mile this odor was dully sickening; from this point it decreased in intensity and intolerability until a point to the windward of the septic tanks and in the vicinity of the filter beds was reached, where

it was not so intensely offensive... The universal testimony (of various persons) was to the effect that, under certain conditions, intolerable odors were appreciable to the limit of from three quarters of a mile to one and a half miles from the works, and that the plant might honestly be considered a nuisance up to these limits."

The editor of the *Engineering News*, commenting on this statement, says: "Undoubtedly the Columbus plant represents the latest and best practice in sewage purification." He also says (p. 599, same edition):

"Most existing sewage-disposal plants are damned by their smell. From the sanitarian's viewpoint, they are (most of them) successful, because they yield an effluent of reduced putrefactive power and reduced disease-carrying capacity, which can be discharged into a stream without causing offense. The scientific sanitarians also aver that bad smells are not of themselves injurious to health. Hence, they say, these sanitary results are well worth buying at the cost of a little smell. There is, however, more or less popular protest against this doctrine. Indeed, the question may be raised whether the sanitary disposal of sewage has first and last any other object than the abolition of bad smell. In so far then, as a sewage treating process produces bad odors, it fails of the object it is designed to accomplish."

It is gratifying to know that the septic tank craze is almost a thing of the past. The septic tank has its uses. It produces results, but it can not be classed as a cure-all. The aim of many sanitary engineers to-day is to demonstrate that wherever this is practicable, sewage should be treated in its fresh condition. It should not be allowed to become septic, neither upon the private premises where it originates nor in the conduits which carry it to the point of disposal nor yet in the sewage purification works, where these are necessary. This tendency is strongly manifest in Europe, particularly in Germany, where more and more attention is being given to the removal of as much solid matter as possible from the fresh sewage by screening. Many examples can be cited where before ultimate disposal by dilution in the flowing water of a stream there is practically no other treatment. On this subject the speaker's impressions are confirmed by the views of Professor H. N. Ogden, who in a recent issue of the *Engineering News* says:

"The city of Frankfort-on-Main, for example, with its population of 375,000, discharges into the river Main, where the sewage flow is diluted 125 times. Similar conditions prevail at Hamburg. There the river Elbe has been artificially made over into a superb inland harbor. Similarly the sewage of Leipzig is discharged into the river Elster, the sewage of Halle into the Saale, the sewage of Wiesbaden and of Cologne into the Rhine.

Broadly speaking, the German attitude toward stream pollution is one of no discrimination between domestic sewage and manufacturing wastes, a careful guarding against putting unnecessary obstacles in the way of manufacturing industries, and a purification of domestic sewage only to that point necessary to prevent a nuisance after its discharge into a stream."

Professor Ogden also says that the Germans

"recognize, apparently, the fact that a river flowing through and by a number of manufacturing cities, carrying shipping of all kinds on its surface and receiving waste waters from many factories, is not and can not be drinking water, and that to establish a high standard of purity for sewage effluents is to impose a needless and burdensome tax on those cities."

But the mistake should not be made of carrying this principle too far. Screening alone is not yet the general practice, not even in Germany, where many cities keep fecal matter out of the sewers, nor can it be advocated as the best, except under peculiarly favorable conditions. It is in most cases considered far better to subject the sewage to some treatment that will advance its nitrification, rendering it for the most part non-putrescible before letting it flow to the stream.

To illustrate: Immediately after my visit to the Wilmersdorf sewage purification works I visited one of the sewage farms of Berlin at Sputen-

dorf. The sewage arrived in a fresh condition at a standpipe on a slight eminence to which it is pumped from the far off city. There was no foul odor noticeable on the farm away from the point where the sewage was actually being applied to the land, and foul odors were hardly noticeable at the margin of the small quarter-acre tract being flooded. The soil, after irrigation with sewage by a method of broad flooding, was left covered with a greasy appearing scum. This forms a crust, clogging the sandy soil, particularly near the points of inflow into the irrigation compartments, and its removal is a source of trouble and expense. It is a question whether other methods of irrigation could not be applied that would in some measure obviate the necessity for removing this material. In this connection it is remembered that for a great many years the sewage of the Stockton asylum was applied by a furrow system of irrigation to a heavy black clay land, which in the course of time became a black, mellow soil. The irrigation there, also, was carried on without becoming a nuisance until the amount to be handled became too great for the small area under intense cultivation. Where on the Berlin sewage farm the effluent from the irrigated fields was seen in the drain ditches, and this is the point to be noted, it was crystal clear and far superior in appearance to the water of the river into which it is discharged. As a rule, the disposal of sewage on land and its use for irrigation, where such arrangement is practicable, has been attended with satisfactory results. But even this treatment has its difficulties and can not be universally recommended, particularly not for regions where soils are heavy and poorly under-drained and winters are long and severe.

Along the line of sewage treatment with the elimination of the septic tank a relatively new arrangement is to be noted which has recently been described by Mr. Chas. Saville, an American engineer at present in the employ at Essau, Germany, of the sewerage department of the Emscher-genossenschaft. The requirements for the improvement of sanitary conditions in the drainage basin of the Emscher River led to the introduction by Engineer Dr. Karl Imhoff of a sludge tank, arranged very much on the principle of the sand-box on our old California mining ditches. The sewage conduit is passed through a long tank 25 feet or more in depth. In the bottom of the conduit are longitudinal openings, with sub-boards or other arrangement so that gases rising from below can not enter the conduit. The sludge tank sides rise to the top of the conduit and close against the same, so that all gases rising from the sludge can be collected in the spaces at each side of the conduit and allowed to escape to the air. The sewage conduit where passing through the tank is made with bottom plates pitching steeply toward the central longitudinal openings, so that the solid matter in the sewage may drop down into the sludge tank. The sewage itself is not interrupted in its flow, which should not exceed a velocity of one foot per second, nor be so low as to keep the sewage within the tank more than two hours. The arrangement, as described, keeps the sludge entirely apart from the fresh sewage. The sewage leaves 95 per cent or more of its solids in the sludge tank, according to Mr. Saville, and the sludge undergoes decomposition without forming malodorous gases. The gases which rise upon both sides of the conduit in the sludge tank are 75 per cent marsh gas and 25 per cent carbon monoxide. There is practically no

sulphuretted hydrogen. The sludge in the course of four or five months is completely decomposed and can be drawn off from the bottom, flowing freely in open conduits to sludge beds. It dries readily, being spadable within three or four days after the water has been drained from it. The sludge effluent is clear without offensive odor, and the sludge itself is also free from foul odors. The sludge resembles humus. Mr. Saville says of the sludge, "When once thoroughly rotted away" it "is unobjectionable in character and is easily handled."

This type of sludge tank at the present time appears so full of promise that its use in connection with the treatment of sewage for our many interior cities and towns will deserve serious consideration. But it is a new device and should be tried out here under California conditions. Some experiments with it are already being made at Philadelphia and at Chicago, and those that are needed here should be undertaken by the University of California. This would be something in the line of original research for which the University should be fully equipped. It is only by taking up more research work of this character that the University can advance to the place which it ought to hold in the front rank of all engineering schools of the world.

I may add in reference to the Imhoff sewage purification tank that in Germany is has passed the experimental stage. It was first used in 1906, and such tanks already serve a population of 250,000.

Though the tendency to so arrange sewage purification works that the sewage may be treated fresh is apparently gaining force, yet there are cases where the reverse may be noted. At Pasadena, for example, where a sewage farm has been in operation for some fifteen years or more, the trouble with sludge deposited on the surface has been increasing, and there is now being installed a septic tank which it is hoped will sufficiently reduce the amount of the solids carried out upon the land to prevent clogging of the soil. It is a grave question whether the substitution in this case of the foul smelling septic effluent, for the comparatively inoffensive fresh sewage, will not more than offset the advantage that will result from the removal of possibly forty to fifty per cent of the organic matter carried by the sewage.

The question of whether or not sewage that is discharged into streams or into large bodies of water should first be disinfected has quite recently received marked attention, notably in the case of Rochester. Plans were made for the delivery of Rochester sewage into Lake Ontario after screening and sedimentation, and it has been determined on the advice of some of the foremost sanitary engineers of the country that no further treatment is needed. While not admitting a full concurrence in the views therein expressed, I quote from the report of Mr. Allen Hazen, of New York. Referring to the plan of allowing the Rochester sewage to flow to the lake after screening and sedimentation, he says, in part:

"In my judgment, the plan submitted is sufficient, and neither of the two auxiliary procedures mentioned need be resorted to. The disinfection of sewage, no doubt, has its uses, but it is a somewhat difficult and experimental process at the present time. If it were carried out in this case its only use, so far as I can now see, would be to tend to protect the water taken by the Rochester and Lake Ontario Water Company from pollution. This water, I understand, is filtered before use. To disinfect the Rochester sewage with this end in view would mean (1) treating a quantity of sewage probably ten times as great as the volume of water, and (2) treating sewage, which is a difficult and expensive substance to disinfect, instead of treating the lake water taken at the filter plant, which is an ideally easy and cheap substance to disinfect. It would certainly

cost ten times as much to disinfect a volume of sewage as a volume of water at the intake, and with the greater volume of sewage it would cost at least one hundred times as much to disinfect the Rochester sewage as it would to disinfect the water taken at the intake. The former would only protect the water from that part of the possible pollution which came from the dry-weather flow of the Rochester sewage, which is probably not the most dangerous part of the flow. The latter would tend to protect the water from pollution of all kinds from whatever sources.

"From every standpoint it is enormously cheaper and also more effective to treat the water than it is to try to protect the water by treating the sewage.

"To treat the sewage by oxidation or nitrification through biological filtration on the shore of the lake before discharging it would be to attempt to effect by artificial processes, at great expense, results that will be accomplished in the lake without cost by the organisms that are in the lake water, and that are introduced with the sewage with the aid of the supply of dissolved oxygen in the lake water present in amounts enormously greater than required for this purpose. To spend money to do in a crude and inefficient way on shore, with resulting inconveniences and nuisances to property owners in the neighborhood, that which otherwise will be freely done in the lake, without expense and without nuisance, is certainly a great and inexcusable waste of natural resources."

I may add to this statement that disinfection does not render sewage non-putrescent. It merely delays the process of putrefaction and may under certain conditions be quite as objectionable as to leave the sewage untreated. But disinfection, nevertheless, plays an important part in many of the sewage problems of the present time, and boards of health, as well as the United States Department of Agriculture, are investigating the use of chlorine, and particularly of copper sulphate, with the effluents of sewage works to better prepare them for discharge into the river systems of the country.

In this connection the statement of the eminent English engineer, Mr. W. J. Dibdin, relative to his experience in treating London sewage, is of interest. (Journal Ass. Engr. Soc., 1908, p. 310) :

"When I received the order to deodorize the London sewage prior to its discharge into the Thames at Barking Creek and Crossness, the only material available in any quantity was chloride of lime. The use of this material produced apparently good results at first, but when the effect of the chlorine disappeared the putrefaction of the sewage matters was objectionable in the highest degree, being worse than the nuisance from untreated sewage. I concluded that we must employ a deodorant which would supply oxygen without acting as a germicide. Permanganates were used, and in order to obtain a sufficient supply, I manufactured it by thousands of tons at Crossness on behalf of the Metropolitan Board of Works. The nuisance disappeared, in consequence of the oxidizing action of the permanganate, which also allowed the aerobic organisms to purify the river while precluding the putrefactive anaerobic action which followed the use of chloride of lime. Of course, my action was resented by the bleach industry, and its foremost representatives argued that the oxidizing power of bleach was greater than that of permanganate for the money expended. The matter was referred to Sir Henry Roscoe, who confirmed my investigations after another £10,000 had been wasted on chloride of lime and the river had been made abominable once more by the use of that material."

He also says, same page :

"Since the dead matters of the sewage are turned into living matters by the use of the trickling filters and the sewage is thereby rendered self-purifying as long as sufficient aeration is maintained, the action of the chloride of lime will be to undo much of the work effected by the filters by turning the living into dead matter. The work thus undone will be repeated in the harbor, just as at present the original matters are rendered live and self-purifying. One wonders, therefore, if the chloride is to be used, what is the good of first treating the sewage on filters."

It is to be remembered, however, that there may be conditions and pathological reasons when disinfection is an essential requirement. On this point Mr. Dibdin says :

"Of course, where there are special pathological reasons for disinfection, and the bulk of sewage is small in comparison with the diluent water into which

it is discharged, the use of chloride is comprehensible. In such a case, however, the chloride may be added to the sewage direct and the cost of filters saved, since the work of the filters will be carried out efficiently by the aerobic organisms in the diluent water when the effect of the chlorine has passed off."

Notwithstanding all the progress in the art of sewage disposal which has been made in recent years, the questions arising in connection therewith are still debatable. The studies of best methods and methods best suited to the various conditions of climate, location, and environment will go on for all time.

The Royal Commission on Sewage Disposal of England, after many years of investigation and study, now recommends a central commission to carry on the work. The Board of Health of Massachusetts, after a quarter century of investigations and the collection of much experimental data, is still adding new results to its notable past achievements.

And now, I may add that the cities on the bay of San Francisco are fortunate in this, that for many years their sewage disposal problems will involve but little more than the securing of a proper dissemination of the sewage in the vast tidal flow of the bay; but as population grows there will be an increasing need for thorough screening and, perhaps, sedimentation of the sewage in some such tanks as the one invented by Dr. Imhoff before it is put into the outfall sewer.

At New York, where at the present time a large intercepting sewer is being constructed for the Bronx, the Metropolitan Sewerage Commission a few months ago took a decided stand against allowing its discharge to go into the Hudson River untreated. The commission points out that when the sewer is completed it will deliver about 1,400 tons of solid matter per annum into the Hudson River, and that this amount will be increased to at least 36,000 tons when the capacity of the sewer is reached.

The Commission says:

"It has been found that practically the whole of upper New York Bay and the lower Hudson are underlaid by an accumulation of foul-smelling black ooze, in which fragments of sewage origin are readily discoverable. These deposits are of considerable thickness, sewage matters having been brought up from a depth of ten feet below the surface of the mud."

The Bronx sewer, to which objection is thus made, is being constructed under permission of the state legislature by a special act approved May 26, 1905.

This action by the Sewerage Commission is prompted by conditions that will never, it is hoped, be paralleled in the bay of San Francisco. They are hardly possible except, of course, in the case of the cities which are separated from the deep waters of the bay by a broad expanse of tidal lands and which are too prone to accept a delivery of sewage into some estuary or slough, in which the tide ebbs and flows, as an ultimate solution of their problems.

At New York the tidal flow is only about one tenth or one twelfth of the tidal flow of the bay of San Francisco, while the population that is contributing to the pollution of the New York waters is five to six times as great as that around the bay of San Francisco. So that even though a rapid growth of population is to be assumed for the bay cities, and particularly for the east side bay cities, objectionable fouling of the bay waters as a whole, if sewage be properly disseminated, must be in the remote future.

But the question is not so easily answered as to what is involved in securing a proper dissemination of sewage in the bay waters. It is manifest that where sewage is allowed to flow into the bay on mud flats between high and low water, that more or less offensive matter will lodge alongshore or on the flats that are only periodically covered with water, and that sooner or later steps must be taken to keep the water front free from such offensive accumulations. The time when some preparations of the sewage for delivery into the bay and when extension of the outfall structures into deep waters will be necessary will surely come for the cities of Alameda, Oakland, and Berkeley.

The question of sewage disposal, with all that this involves both for cities that are favorably located on large bodies of tidal waters, and for the municipalities whose problems will be of a more intricate nature, is always a timely one and peculiarly appropriate to receive careful attention by the medical profession, whose active support the sanitary engineer relies upon when such vital problems are presented for final decision.

### **NEW DEVELOPMENTS IN SEWAGE PURIFICATION IN CALIFORNIA.**

By NED D. BAKER, Engineer Inspector, California State Board of Health.

In the August, 1910, number of this Bulletin, the subject of "Septic Tank Effluents" was briefly treated and the necessity for further purification of sewage was pointed out. In the present number, several plants for treating the septic effluent are described. These new plants mark a new era in sewage purification in California. A little over a year ago nothing of the kind was to be found in the State, and the conditions leading up to the building of these plants furnish an interesting study.

In every case the primary object was to prevent a nuisance rather than because of sanitary reasons. It is a well-known fact that if a putrescible effluent, such as that from a septic tank, be turned into a stream that has not enough water to oxidize it, a nuisance will result. In designing the works for aerobic treatment of the sewage, the effort is made to carry it through the final stages of oxidation so that the effluent will be stable.

The two distinct types of design represented are the contact beds and the sprinkling filters. Both are designed to bring the partially purified sewage into touch with rich cultures of nitrifying bacteria and artificially produce the conditions best suited for the growth of these organisms. They are both purely biologic in their action. As the septic tank represents intensive action of anaerobies or putrefactive organisms, so the contact beds and trickling filters are made the field of intensive action of the aerobic forms or those that use air and oxidize the organic matter.

Just what is the fate of the pathogenic or disease-producing germs in this process has not been definitely decided. But it is very probable that few of them escape. There is, however, a wide variation in opinions on this point.

*Contact beds.* This form requires the building of a water-tight receptacle, which is filled with coarse material, such as broken stone, cinders,

clinkers, or the like. The filling material is selected with a view to getting a large total area of surface exposed, and a material that will drain quickly and will not break down and thus cause clogging of the filter.

The beds are operated in "cycles," that is to say, a bed is filled and allowed to stand full for several hours, the time depending on temperature and other conditions. Then it is emptied and stands empty for several hours before refilling. Large plants in the eastern part of the United States are operated in from two to four such "cycles" in twenty-four hours. This necessitates having separate units so one set can rest while the others receive the sewage.

The large number of surfaces in the filling material become covered with a slimy film, which is really a very rich culture of bacteria. When the sewage is brought into contact with these films there takes place a rapid nitrification of the organic substances in it. A process that under ordinary conditions would require several days or weeks is accomplished under these highly favorable conditions in a few hours. When the beds are empty and the voids filled with air the culture films of bacteria have a chance to recuperate, as it were, because they require a great deal of oxygen in their life processes.

*Double contact.* This is the treating of the sewage in two contact beds run in series, the second receiving the effluent of the first. In 1905-07 Winslow and Phelps, at Boston, got fairly good results with double contact beds six feet deep, filtering at the rate of .7 million gallons per acre per day.

*Controls.* There are now on the market a number of automatic devices for controlling and regulating the flow of sewage through the contact beds. In recent designs a "dosing chamber" is built and the controls so put in that the beds will be dosed and emptied at previously determined intervals. The State Board of Health has data on a number of these patented devices and would be glad to communicate with anyone interested.

*Trickling filters.* This form of aerobic treatment depends on the same general principles as that by contact beds, but differs in its mode of application. The trickling filter is essentially a bed of coarse material, on to which the sewage is thrown in a fine spray. The only one the writer has seen in operation in California is at the Sacramento County Hospital, near Sacramento. Unlike the contact bed, the trickling filter has no tight walls. The continuous and free passage of air through the filter during operation is conducive to the best results.

The sewage, being aerated by the spray application, trickles down over the surfaces of the broken stone or other filling, being brought into intimate contact with the bacteria cultures in the slimy films on the rocks, also being continuously in contact with the air in the interstices. The material is so coarse that little or no mechanical straining is expected, the bacterial action being almost wholly responsible for what purification takes place.

In the experiments made on the purification of Boston sewage it was found that as good results could be had from sprinkling filters as from contact beds, and that a higher rate of filtration could be used. They require more constant attention, and under some circumstances are less desirable for this reason.

*Slow sand filters.* Unless the solids are first largely removed and the sewage put through some preliminary process before being put onto sand filters, considerable difficulty is likely to result from clogging.

In this State natural sand and gravel beds are in many cases available. These have rarely been under-drained by tile, and owing to difficulty in collecting fair samples of the effluents, the degree of purification effected by them can rarely be studied. They are frequently farmed during a part of the year and so the system resolves itself into a combination of sand filtration and broad irrigation in such cases.

Purification by slow sand filtration is partly due to the mechanical straining effect of the sand, and partly to the bacterial action of the organisms in the upper layers of the filter. There the nitrifying bacteria collect and multiply to a high degree and work over the organic matter deposited. After the filter has been in operation for some time the jelly-like masses in the upper layers of the sand strain out more and more of the impurities, but they also cause a lowering of the rate of flow and eventually make it necessary to clean, or rest, the filter.

*Electrical purification.* At Santa Monica, near Los Angeles, is a plant which is claimed to purify sewage by passing an electric current through it. Since this is the only plant of its kind in operation, and since the State Board of Health has not the results of any authentic tests of it, it is not thought well to do more than mention it at this time. Perhaps later the Board will be able to make public some figures on the efficiency of a plant of this kind.

*The septic tank.* The old theory, still held by an isolated few, that the "septic tank" is all that is necessary in the treatment of sewage, is rapidly being disproven. The hope that it would solve the "sludge disposal problem" finally is meeting with disappointment the country over.

In an article in the Journal of the American Medical Association of December 10, 1910, Dunbar, a German student of sewage disposal, is quoted on this subject as follows:

"At first it was maintained that the sludge was entirely liquefied and gassified; then that it was reduced by fifty per cent; and, as a result of the most recent investigations of which I am aware, it is stated that the amount of sludge is not reduced by more than nine per cent."

Winslow and Phelps, in their "Contributions from the Sanitary Research Laboratory," published in 1909 by the Massachusetts Institute of Technology, give the results of long series of experiments on the purification by trickling filters of both raw sewage and septic tank effluents. It was their experience that the tank effluents were more difficult to deal with than the fresh sewage. Note the following conclusion:

"On the whole, then, it may be said that apart from the advantage that may also be obtained by simple sedimentation (four hours or less), the septic tank has little to recommend it. The slightly increased digestion of sludge is in large degree counter-balanced by the added difficulty of treating the septic effluent."

That the septic process will always occupy a large and important place in the sewage purification of California there seems little doubt. In many places the sewage is used during the dry season for irrigation, and in most of these the tanks are useful for removing and storing the solids for long periods of time. Especially is this true of smaller communities, where the tanks have little or no close supervision.

The records at this office show that of sixty-three California municipalities that are now operating, or will soon build, septic tanks, only five are making any provision for further purification of the effluent. The water from thirty-nine of the tanks is used for irrigation for most of the year, eight of them discharge into the ocean or other salt water, and eleven run their effluents into inland streams or sloughs. Those five towns that will further purify their sewage all are doing so to avoid the possibility of creating a nuisance in the streams into which they discharge. On the other hand, a dozen or more cities and towns of the State discharge their sewage directly into streams without any purification.

On the whole, we seem to be on the eve of a widespread and radical change in our ideas and policies regarding sewage disposal. The more complete purification processes are being studied and fitted by our engineers to California conditions. These conditions differ in many ways from those in the older states where such processes have been used, and the California engineers have been at a distinct disadvantage in not having the results of local experiments. The plants being designed without this data, and being fitted to local conditions purely on theory, it will not be surprising if some of them fall short of the results expected of them. But these engineers are deserving of much credit as pioneers in this most important branch of the profession in California.

The works they have installed will be watched with interest, and the future progress to be made along these lines in our State will owe much of its success to these first beginnings.

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## **SEWAGE DISPOSAL WORKS AT PLEASANTON, CALIFORNIA.**

By PAUL BAILEY, with Haviland & Tibbets.

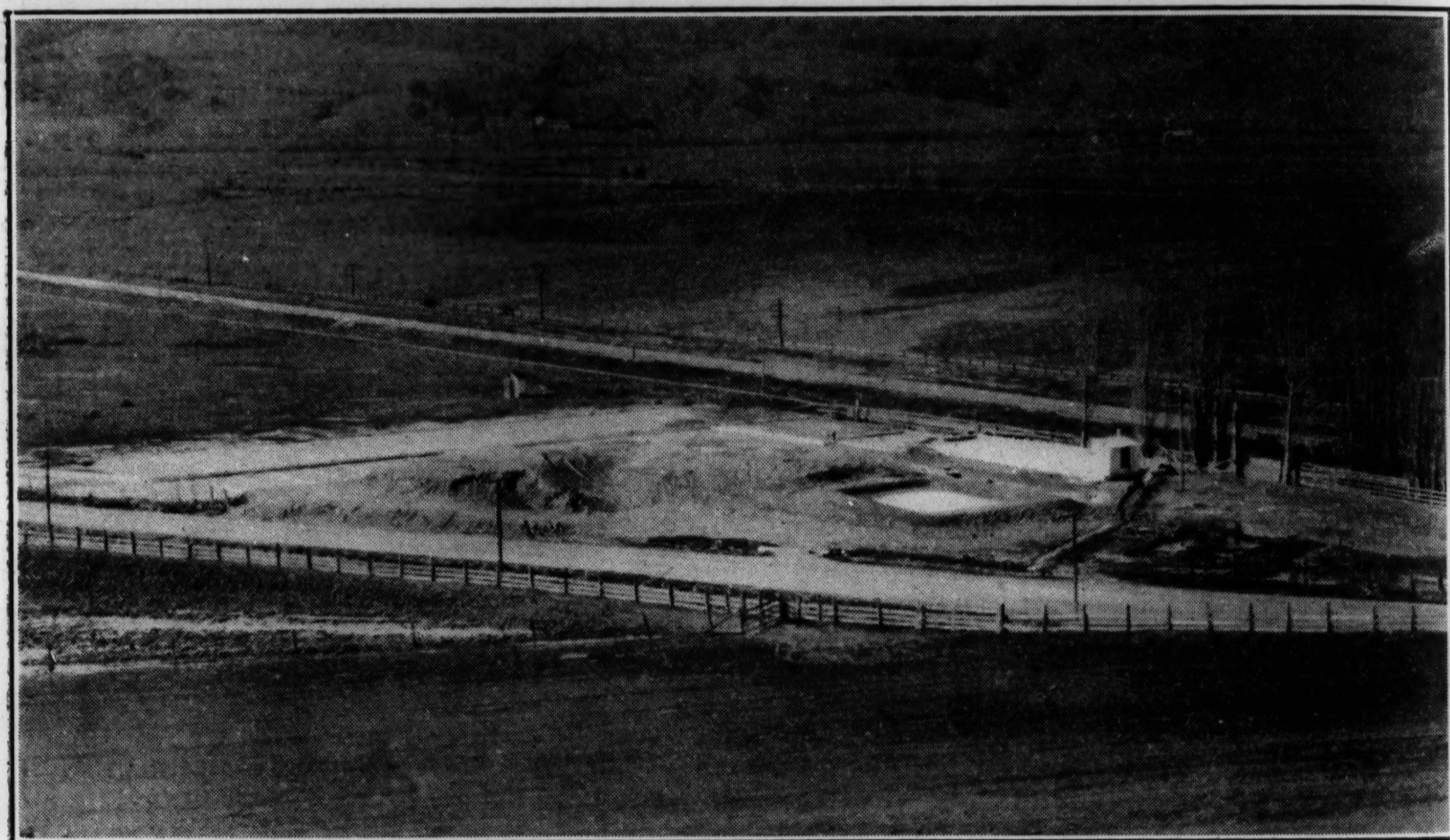
The town of Pleasanton lies in the center of a rich farming district of the Livermore Valley, about forty miles distant from San Francisco. It supports some 2,000 inhabitants. Up to the spring of 1911 the wastes of the town were cared for entirely by cesspools. Conditions becoming insanitary, however, it was desired to install a sewerage system.

A collecting system, consisting of some  $7\frac{1}{2}$  miles of sanitary sewers, ranging in size from 6 inch to 16 inch, was laid. This gave connections to all the settled portion of town, which is about five eighths of the total area within the incorporated limits. The grades were so set and the manholes so placed that the remaining portion can be sewered by constructing additional laterals. As with many towns similarly situated, the topography is very flat and the town rather extended. Only by a

most careful study of the situation could a system of piping with the required grades be obtained which would not run into excessively deep or shallow cuts for considerable distances.

The sewage is carried by the 16-inch outfall line to the southwest corner of the town, where, just outside the city limits, the disposal works are located on a triangular-shaped piece of land between the Southern Pacific Railroad and the county road.

The general problem of disposal was one of unusual perplexity, due to the high sanitary requirements, the small head available for operation of the works, and the limited means of a town of the size of Pleasanton. The only outlet for sewage from the town is Alameda Creek. Since this creek has a very small summer flow and since it is subsequently used for a water supply, it behooved Pleasanton to purify its wastes to the extent that the waters of Alameda Creek could not become dangerously polluted. Also, since the town is situated on the floor of the valley,



General view of sewage disposal works, Pleasanton, Cal. Septic tank on right, intermittent sand filters on left, and sludge basin in foreground on right.

which is broad and flat, not over  $4\frac{1}{4}$  feet of head could be allowed the disposal works without recourse to pumping. Continuous pumping is always undesirable in a small plant on account of the constant operating expense and on account of the difficulty of procuring proper attendance. This precluded the use of many ordinary methods of purification, such as sprinkling filters, aeration, etc., which require considerable heads for operation. The plans adopted which seem to best meet the requirements of both sanitation and economy are a combination of septic action with broad irrigation and intermittent filtration.

There being no manufactories in Pleasanton, the sewage is entirely domestic and is consequently well adapted to septic treatment. Followed by an effective oxidizing process, such as broad irrigation, this would then give very satisfactory results. It is impossible to maintain a sewage farm profitably, however, which will handle the entire effluent the year round. In most instances the greatest supply occurs when the

crops on the farm need it the least. Intermittent filter beds were therefore designed to take care of that part of the effluent which can not be used in irrigation.

The accompanying photograph shows the general arrangement of the disposal works. The septic tank at the upper end consists of two parallel tanks of plain concrete, each 80 feet by 13 feet in plan and 7 feet deep. These are covered with a 3½-inch reinforced concrete slab, supported on cross-girders. Access to the tank is gained through manholes at either end. A 10-inch vent pipe, extending well above the roof, allows the escape of gas. At the inlet end of the tank is a small screening chamber, next to which are two grit chambers 2 feet in width, which extend cross-wise to the tank. Redwood stop planks cover both the screen and grit chambers to permit of easy inspection or cleaning. The entrances from the screening chambers to the grit chamber are controlled by two 10-inch gate valves, with extension stems and indicator standards, operated from the roof of the tank. The sewage passes from here into the main compartments of the tank through two rows of 8-inch tile placed in the dividing wall 12 inches and 24 inches from the bottom of the tank.

The sludge will be removed from the tank by a 6-inch horizontal centrifugal pump directly connected to a 10-horsepower electric motor. This is placed in a small galvanized iron pump house on the roof of the tank at the inlet end above the sump. A sludge bed, 40 by 50 feet, in plan, is located to one side of the tank to receive from the pump.

The effluent from the septic tank is taken off opposite the inlet end. The collector consists of a redwood box 2 feet square in cross section. This is placed 30 inches on center above the floor. Two rows of 3-inch by 12-inch slots in the side of the box allow the water to enter. It is then carried to a 5 by 3 foot forebay by 10-inch piping, regulated by gate valves from the roof of the tank. From here it flows over a weir into the dosing chamber.

The dosing chamber is a concrete basin 27 by 33 feet and 18 inches deep. This is designed with an automatic gate at the outlet which empties the basin each time it completely fills. With such an arrangement, the effluent is turned intermittently down a concrete flume 36 inches wide. This flume passes over the center of a gravel filter bed and then turns to run down the high side of the irrigation farm. Water is taken from the flume by small openings spaced 10 feet on centers. The quantity is regulated by wooden slides covering the openings, and stop boards fitting in grooves in the flume. When the water is to be used for irrigation on the farm, the automatic gate can be caught open, allowing the septic effluent to flow continuously down the flume to the farm.

The filter beds were made by filling in an excavation with clean unscreened creek gravel. They have an area of 0.46 acres and an average depth of almost three feet. Four-inch drain tile spaced in rows 10 feet apart feeds the bed on the surface. Staggered rows of 4-inch tile drain the filter into a 10-inch line, which extends along the low side of the irrigation farm and empties into a ditch, the final outlet of which is in Alameda Creek.

The irrigation farm covers about 8.0 acres. It occupies all the remaining portion of the disposal works site. It will be planted to suitable crops, probably alfalfa, in proper season.

The ultimate capacity of this system is designed for a population of 8,000, giving sewage at the rate of seventy-five gallons per capita per day. The outfall sewer flowing full will carry about 2.8 times this amount, the allowance for maximum over the average flow. The disposal works are designed with only one half the ultimate capacity since the present population of Pleasanton is only 2,000. This can be easily increased by adding units to the septic tank and increasing the area of the filter beds. At present, one unit of the tank will treat the sewage with an eight-hour storage.

With this scheme of disposal the entire effluent of the sewers can be efficiently handled and at the same time the farm can be operated to the greatest advantage for raising crops. It is expected that the revenue from this source will, in a large measure, pay for the cost of maintenance of the disposal works. The contract price for the entire disposal plant was \$6,667.00.\*

### **THE SEWAGE DISPOSAL PLANT AT SANTA CLARA.**

By C. E. MOORE, City Engineer, Santa Clara, Cal.

The matter of securing a suitable site for this plant was under consideration for several years, and many obstacles were encountered. The old sewer outlet is into the Guadalupe Creek, which is practically dry in summer and a raging torrent at times in the winter. It was difficult to obtain a site near this creek, which in many ways would have been the easy solution. Also, the country in that vicinity is subject to overflow, and a great part of it has been covered during late rains, some of it to a depth of five feet. Other sites could not be secured without long delay by litigation. Finally the present site was obtained, and it remained for the engineer to do the best possible with an undesirable site. The entering sewers are necessarily about seven feet below the surface of the ground. The effluent can not be allowed to flow away in open ditch, but must be conveyed by a pipe. Also, the location, which must be made for this effluent pipe, makes it necessary that the grade of this pipe be one foot above the ground surface, where it leaves the plant. Of course, all this means, first, that the sewage must be pumped, and second, that the greater part of the construction must be above ground. It was desired to use septic tanks and filters. Trickling filters were used, laid in graduated layers, somewhat along the lines used by Dr. Dunbar in Germany.

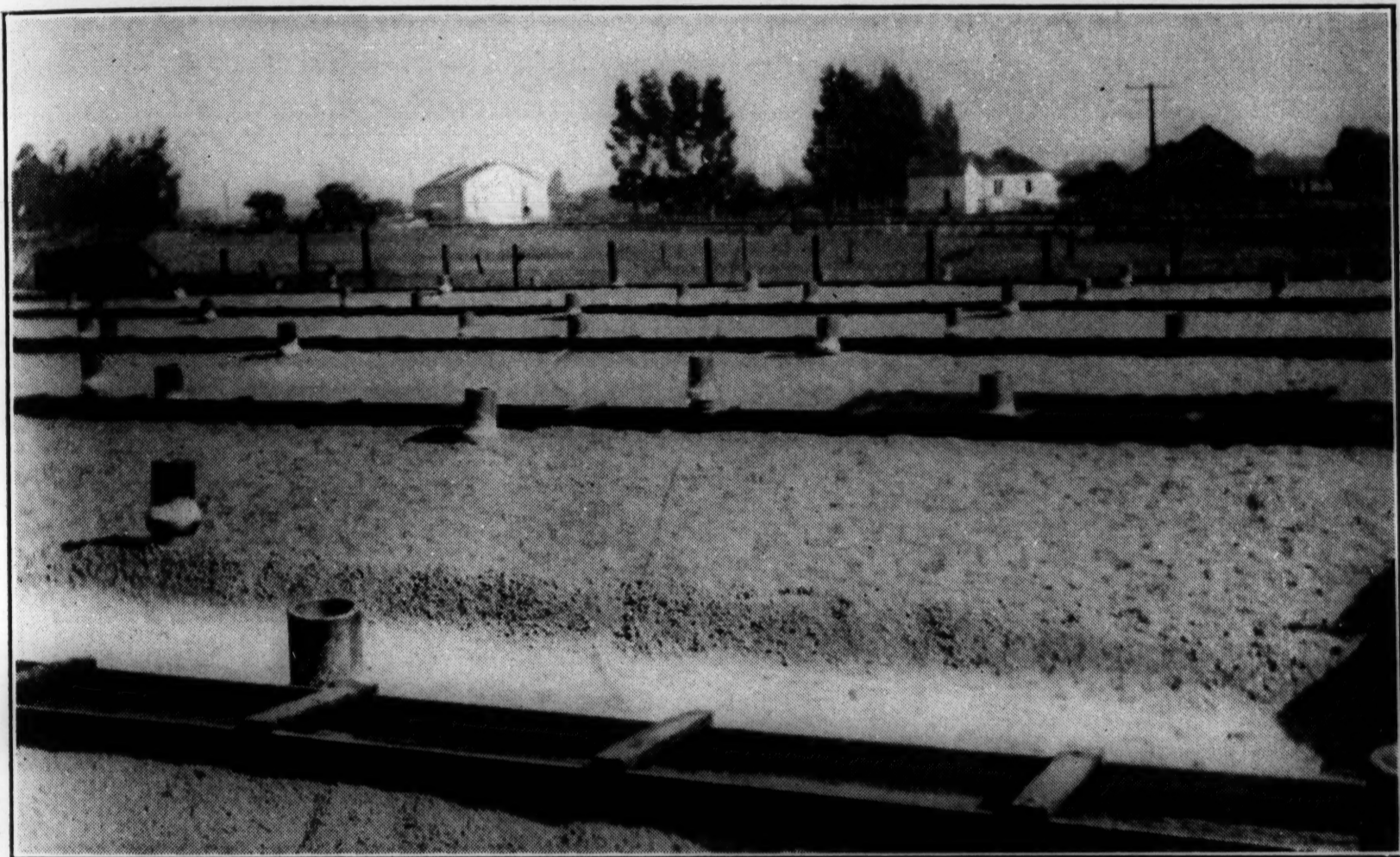
The sewage is received in a concrete pumping pit, and lifted to the tank by centrifugal pumps. At present there are two pumps, each having a capacity of three hundred gallons per minute. Each is directly connected to its electric motor, the pump being at bottom of the pit, and the motor above the floor (or above the ground surface). The motors are controlled by floats, and ordinarily only one pump is working, and that not continuously. If at any time the flow becomes too great for one pump, the other begins to work. Later, as the quantity increases, it is expected that one pump will work continuously, and the second pump also a part of the time. Also, it is intended to place a third pump

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\* The designs were made and the plant installed by Haviland & Tibbets, San Francisco.

or other lifting device, which shall be of a capacity about equal to the two now in. The sewers leading to the plant lay in very bad ground, so that there will be some infiltration water, the quantity not yet being known. Also many sewer extensions have yet to be built, which will increase the quantity to deal with.

Undoubtedly, quite as good results could be obtained with smaller settling tanks in connection with filters. However, this involves the removal of a much greater quantity of sludge, and on this account the septic tanks were used. There are two parallel tanks, each  $14\frac{1}{2}$  feet wide and 92 feet long, the sewage being  $7\frac{1}{2}$  feet deep. The total capacity of the two tanks, with the inlet and outlet chambers not included in above dimensions, is about 155,000 gallons. The tanks have a concrete floor, a reinforced concrete roof, and reinforced concrete walls. The structure



Sewage filters, Santa Clara, Cal. Wooden trough distributors and tile vents to underdrains.

is necessarily placed with the greater part above the ground surface, the bottom being about  $2\frac{1}{2}$  feet below that surface.

There is much doubt as to the reliability of reinforcement in concrete walls holding water, as one can hardly be certain that the inner surface is made perfectly waterproof. In this case the inner surface was treated with waterproof coating, and the few leaks were easily taken care of. Also below the water line a series of buttresses is constructed to take the water pressure. These are placed so close together that little danger can be apprehended, even should the reinforcement for that part be entirely destroyed. It will, of course, occur to the reader that the tanks should have been made deeper, being set lower in the ground. This was not done on account of the treacherous nature of the ground, which is adobe, underlaid with quicksand.

From the outlet chamber, the effluent is taken by conduits to six filters. These filters are each 20 feet wide by 100 feet long. The floor is of concrete, and is placed from 1 foot to 18 inches above the ground surface,

this being necessary to reach the outflow sewer. The whole is surrounded with a light wall of reinforced concrete. The floor of each filter slopes from the longitudinal center line or axis, to collecting channels placed on the line between adjacent filters. There is also a larger collecting channel outside the end wall, receiving the flow from the individual collecting channels, and conveying it to a small outlet basin at the corner of the filtering area, from which it is taken by the outflow sewer. The collecting channels between the filters are formed by leaving a depression in the floor, which is covered loosely with brick, not laid in mortar. The fall in the floor, from longitudinal axis to collecting channel, is 6 inches. The filters are 3 feet deep along the axis, and  $2\frac{1}{2}$  feet deep at the channels. Therefore, there is a fall of one foot in the filter surface each way from the axis. The filtering material is made to form a ridge over the channel, the depression in the the filter being slightly to one side of the channel.

The distributors in use were made as a trial, their construction being temporary. Each distributor is laid along the center line of its filter. It consists of a wooden trough with bottom 12 inches wide. The sides slope outward, so that at the top the width is 16 inches, the depth being 6 inches. Along each side a strip of old roofing tin is nailed, projecting 2 inches above the wood. The tin strip is bent outwardly at the bottom, forming a sloping shelf, which prevents the effluent from following down the sides of the trough. The portion projecting above the trough has two rows of holes 1 inch apart vertically, the holes being 3-16 inch in diameter. They are spaced uniformly to give the required number as determined by trial. The flow is first through the lower row, and if the flow becomes too great for these, then through the second row. As stated above, these distributors were constructed upon trial. However, the entire distribution works very well. The sewage drips from the sloping shelf and follows the slope of the filter surface, gradually passing through the first layer, and all disappearing before reaching the point of greatest depression. Probably when these distributors have outlived their usefulness, others of very similar form will be constructed in a more permanent manner.

The filter is made up as follows, beginning with the top layer :

*First.*—Layer of sand, size one sixteenth inch to one eighth inch, depth three inches.

*Second.*—Gravel—Three sixteenths inch to three eighths inch, depth three inches.

*Third.*—Layer of gravel, one half inch to one and one quarter inch, depth four inches.

*Fourth.*—Layer broken rock, one and one half inch to two and one half inch, depth six inches.

*Fifth.*—Broken rock, three inches to nine inches, depth fourteen to twenty inches.

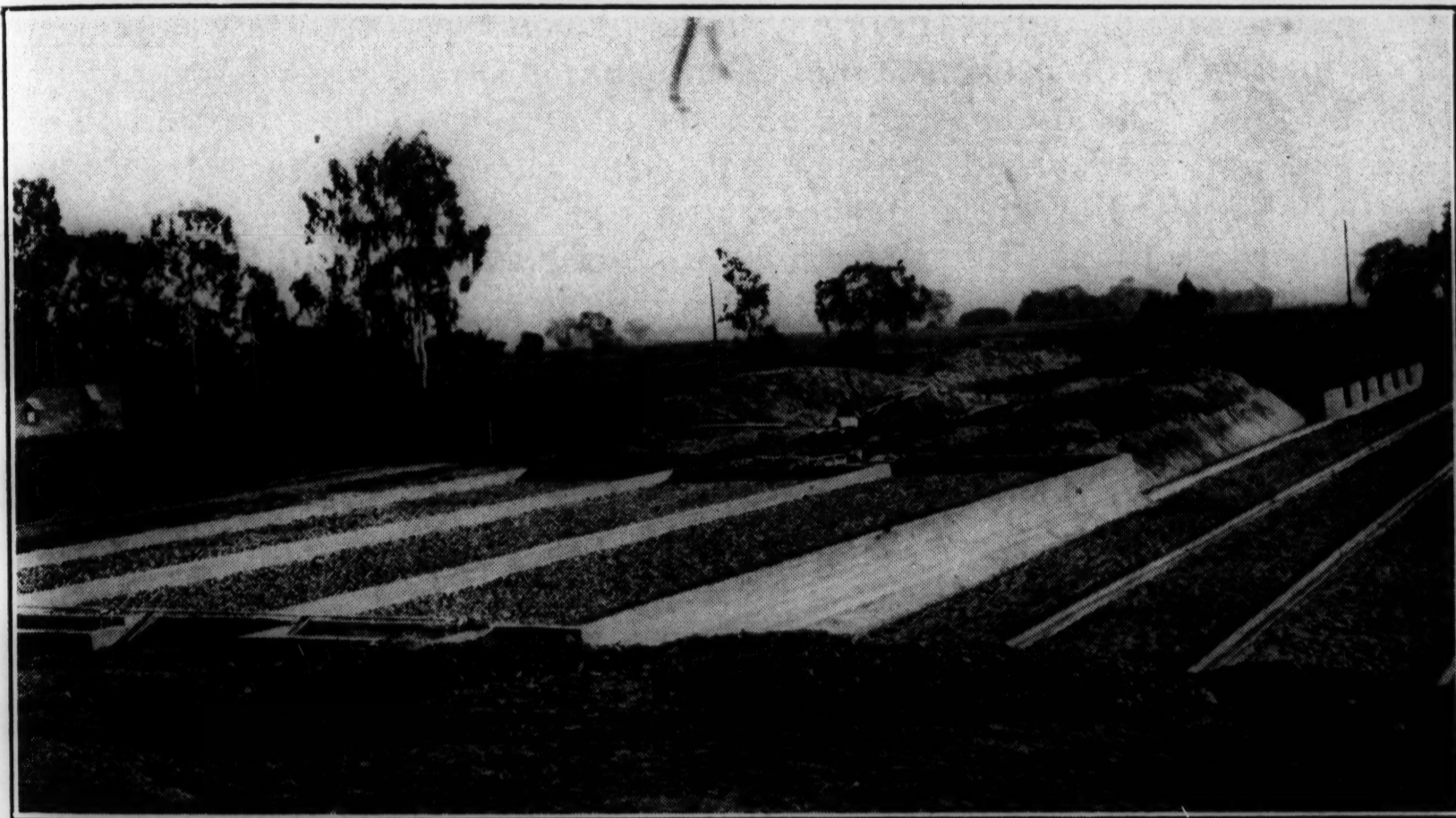
The plant has been working but a few weeks only. However, septic action has begun, the filters seem to be doing fair work, and it is expected that the total result will be satisfactory. A very high degree of purification is not required. The population of the town is slightly over 4,000, with prospect of some increase. In operating the filters, one is resting at all times, a change of the valves being made daily.

## LODI SEWAGE DISPOSAL PLANT.

By MR. H. H. HENDERSON, City Engineer of Lodi.

The problems of sewage disposal in our western towns are requiring more consideration each year. The increase in population in the outlying districts is constantly lessening the possibilities of discharging the sewage upon unused tracts. The pollution of our streams is more carefully guarded against; hence the necessity of securing better methods of disposal.

Difficulties that have to be contended with by the average city are numerous, viz.: Inadequate funds to investigate the disposal; the opposition given by the public of the district in which the sewage must be treated; later, the improper attention frequently given to such disposal plants after completion. In many instances the method of clarification, when installed, has proven satisfactory. The increased flow of



General view of sewage purification works at Lodi, Cal. Contact beds on left, sand beds on right, septic tank in distance.

sewage and the manner of discharge are frequently neglected, which results in missing the results sought. It is hardly necessary to go into a technical discussion of the septic process, further than to say that it is due to micro-organisms of zymotic origin.

The city of Lodi, which is situated in the northern part of San Joaquin County, found itself confronted with the necessity of caring for its sewage. After a deliberate examination of the probable channels by which it might dispose of its effluent, it was decided to clarify the sewage by means of septic treatment, and to that end the following described plant has been constructed. The tanks and filters are of reinforced concrete construction. The septic tank was built in two units, placed side by side. Each unit has a width of 20 feet by a length of 80 feet, with a mean depth of 5 feet. Along the upper end of the tank is carried a supply-chamber; the sewage being fed into the tanks from the bottom of the trough in such a manner that either unit, or both,

may be operated. The bottom of each unit is designed with a sludge trough, so that all the sedimenting substances may be removed without disturbing the general effluent. At the lower end of the tank the sewage is drawn off into an aerating chamber through eight weir gates. This chamber is so designed that the effluent may, if required, be quite extensively aerated.

Means have been provided in the septic tank for the location of baffle-boards, so as to retain the mat in any position. Also for the placing of screens at the weirs. After passing through the tank, the effluent is carried to the dosing chamber, from which it is discharged on to the contact filters. These filters are constructed in triplicate, each having a width of 20 feet by a length of 80 feet, with a depth of 4 feet. They are situated side by side and so arranged that one dosing chamber suffices for all filters.

The concrete floor of these filters was laid with sufficient grade for drainage, and on the floor was placed a continuous line of tile inverts connected with an outlet timing syphon. Upon these inverts was placed a 30-inch layer of broken stone. The timing syphons used are of the Pacific flush tank manufacture, and are so arranged that the tanks are charged and discharged consecutively; the time of discharge and the period of feeding of the bacteria being subject to regulation.

From the contact filter the effluent is carried to the sand filter, entering a distributing chamber. The sand filter is 195 feet wide by 250 feet long, having a depth of 30 inches. This filter has not the concrete floor as provided in the other, but was constructed with a 2-inch layer of fine rock firmly tamped to grade. Proper slope for drainage was provided. Upon this floor is first placed tile inverts, over which is laid a 9-inch layer of  $1\frac{1}{2}$ -inch crushed rock. At the lower end this layer increases in depth, so as to bring its upper surface to a level. Over this layer are placed four inches of  $\frac{3}{4}$ -inch rock, and on top of this is a 6-inch layer of coarse, sharp sand.

Across the filters lengthwise are placed eighteen lines of concrete troughs, whose supports are below the bed of the filter, so as to provide for cleaning. These troughs are level, so that the effluent may equally deploy over the entire bed. The troughs are fed from the distributing chamber, which is provided with weir openings for regulating the flow.

Piping has been so placed that the sewage may be by-passed any or all of the filters so as to allow for needed repairs or cleaning. The flushing devices of the contact filters are so arranged that one or more of the contact filters may be operated.

Only a part of the sewage of the city is at present reaching the plant, but the process of clarification has begun, and from all evidences, if proper care and management are given, the plant will meet all requirements. Space has been provided so that should occasion arise for the chemical treatment of the effluent, it may be carried on without interference with the plant. The effluent, after clarification, will be discharged into tidewater.

The cut shows the septic tank (in the middle distance on right), the contact filters (at left), and the sand filters (at the right).

The city council rendered unusually valuable service in the effort to provide adequate disposal of the city sewage, and such service is of

paramount importance in the proper determination of the process that shall be adopted. The limiting power of bond issue and the valuation of a city's property often prevent our smaller towns from making a successful determination and disposition of such problems.

NOTE.—The sewerage system and sewage disposal plant of Lodi were designed and built under the direction of Mr. H. H. Henderson of Stockton, at a total cost (exclusive of engineering) of \$49,941.

### AN INEXPENSIVE "SEPTIC TANK" OR SETTLING POND AT RIVERSIDE.

By A. P. CAMPBELL, City Engineer of Riverside.

About 1904 we were emptying our sewage into the Santa Ana River. On the other side of the river was a large area of almost pure sand. This was cleared and the sewer outfall extended to it, crossing the river by means of an inverted syphon. The raw sewage applied to this sand-bank soon changed it to alfalfa fields and then Chinese vegetable gar-



"Septic tank" pond at Riverside, Cal., showing brush baffles and sludge mat.

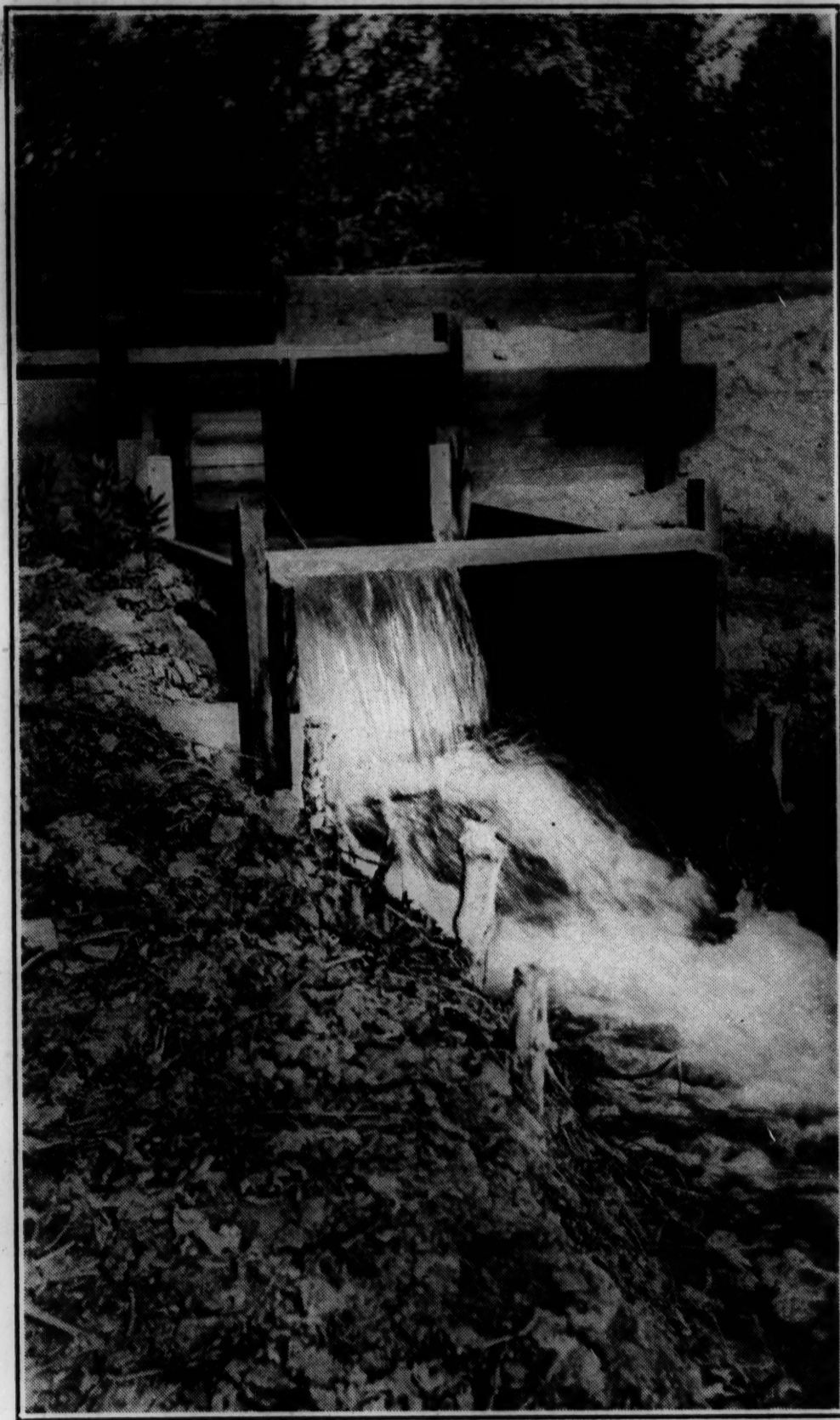
dens. The understanding was that no vegetables were to be grown with the raw sewage; the land was not to be used for vegetables until the next season.

But, although the owner of the land acted in good faith, the Chinamen commenced conducting the water by night to the vegetable plots. This became advertised in the papers, and the City Board of Health instructed me to cut the sewage out of the Chinese gardens entirely. I did so in the following manner. Between the river and the Chinese gardens was a strip of sandy land, about four feet lower than the gardens, and by opening the pipe as it passed through this strip, I diverted the sewage and made it useless for the Chinamen to take it. Now, without cultivation and care, it was making a foul mess, so in order to liquefy and settle it so as to let it sink readily into the sand, I

constructed a liquefying basin. (I do not call it a septic tank, as all the refinements of a septic tank are lacking.)

The basin or pond is about 300 feet long by 90 feet wide and about 5 feet deep. It was constructed with city teams and scrapers by excavating the bottom and building up the sides. It was necessary to construct only three sides, as the fourth was formed by the bench land of the Chinese gardens.

A wooden intake was constructed at about the 3-foot level from the



Aerating the effluent at Riverside, Cal. A necessary step in complete purification of septic sewage.

bottom and an outlet at the far end and on the same level. Across the pond a number of brush fences were built, reaching out from the bank to past the middle, alternating, the idea being to prevent the action of the wind on the surface of the pond. At the lower end and around the outlet, a double fence of chicken wire was made and filled with brush to act as a strainer.

To make a cover for the affair was the next question. It was made by letting the pond fill with sewage, then throwing on straw and litter until the surface of the sewage was entirely covered. The brush fences prevented this floating cover from drifting.

The septic action set in and a good mat formed under the straw. The effluent came off clear, and a few hundred feet from the pond no one would suspect it was sewage water.

This basin was installed during the summer of 1909. During the winter of 1909-10 a corner of the basin was washed out by the overflow of the river. This break was repaired early in the spring of 1910, and the pond has been in continuous use to date.

The effluent from the basin is conducted to furrows in the sand and allowed to sink, except that a patch of alfalfa of some twenty acres is watered by it. This same alfalfa used to be flooded with the raw sewage and was useless as a salable article. Now, using the water after passing through the basin, there is no complaint.

During the summer there was complaint of the mosquitoes in the river bottom, and many thought that it came from the sewage disposal. To stop criticism we bought a tank of distillate and an orchardist's spray pump and sprayed the top of the pond and all stagnant pools of water in the vicinity of the disposal plant. This was more precautionary than really necessary. To further safeguard the public, we have kept a man on duty every day, Sundays and holidays included, from the beginning of 1909 to date. His duty is to see that the water is properly disposed of after leaving the tank, and that no illegal use is made of it. Continuous measurements of the amount of sewage have been made since last August and will be of use in future planning.

Riverside's population at the 1910 census was 15,212. All the business section of the city is sewered and enough of the residence portion to cover probably 7,000 of the population. The extreme capacity of the pipe is 125 miner's inches and our present maximum flow goes to over 100, averaging around the 60 mark.

NOTE.—Mr. Campbell's figures show an average sewage flow of about 780,000 gallons per day from an estimated population of 7,000, or an average flow per capita per day of about 110 gallons.

The tank capacity is about 600,000 gallons, or average about twenty hours. The area is 27,000 square feet, or nearly four square feet per person on the system.

The automatic recording device will show some very interesting studies of the hourly and daily variation of the sewage flow of a city the size of Riverside.

## **SEWAGE DISPOSAL PLANT AT EAST SAN JOSE.**

By HENRY B. FISHER, Town Engineer of East San Jose.

The East San Jose sewerage system is designed as a separate system, the storm water being cared for in a different way. In all, there are about 11 miles of 6-inch pipe, one mile each of 8 inch and 10 inch, three quarters mile of 12 inch, and one half mile of 14 inch pipe. The system is designed to care for a maximum population of 8,000.

From the outfall pipe the sewage flows into a covered septic tank of 17 feet by 118 feet by 10 feet, inside dimensions. The effluent from the tank is conducted into contact beds, so arranged as to have a continuous flow through large rock (3 inch to 6 inch) for a distance of 300 feet, the depth of the rock being 2 feet and the width of the channel 10 feet. There are two beds, the intention being to use one for twenty-four hours and allow it to rest for twenty-four hours. The tank and contact beds are made of concrete, and are designed for a population of 3,500, our idea being to build others as soon as the increase in the sewage flow demands them.

The system, together with the tank and contact beds, was constructed by John McReynolds for the contract price of \$29,900. There will be some addition to this for extra work performed. The designs were made by Henry B. Fisher of San Jose, Chas. E. Moore of Santa Clara acting as consulting engineer.

## EDITORIAL COMMENTS.

### THE PURPOSE OF THIS BULLETIN.

The State Board of Health has endeavored in this Bulletin to present in non-technical language a thoroughly trustworthy and scientific statement of the present-day thought with reference to municipal problems of sewage disposal.

It is not expected that this issue of the Bulletin will prove of general interest to the public, even though the contributors have spent a great deal of time and successful effort in avoiding the technical terms and references so essential to the usual professional paper on engineering.

It is hoped, rather, that this Bulletin will prove valuable to members of boards of trustees, to county supervisors, to special committees, and to editors and other residents of communities in which the problem of sewage disposal is under consideration.

California now has over 1,500,000 citizens living in communities provided with some sort of a sewerage system. A majority of these systems have no provisions for treatment, and only a few of them have been devised with the intention of ultimately adding such provisions. It is believed that this Bulletin will be useful in these communities, as well as in others which have as yet made no beginning in sewage disposal.

The importance of the subject warrants some assurance that the articles presented are by men possessing wide practical experience as well as thorough scientific training. For this reason the following information concerning the authors of the three general articles is given.

*Charles Gilman Hyde.*—Professor C. G. Hyde is a graduate of the Massachusetts Institute of Technology. In 1896, he entered the service of the Massachusetts State Board of Health, being advanced to assistant engineer in charge of maps, plans, and preparation of cost-estimates of sewerage works and outline schemes for sewage disposal for towns. In 1900, Mr. Hyde accepted an appointment with the Spring Garden Filtration Testing Station, Philadelphia, and subsequently built and operated the Torresdale Filtration Station on the Delaware River. From 1902 to 1905, he was assistant engineer in charge of the filtration station, and the design and construction of municipal filtration works for the improved waterworks of Harrisburg. In addition to his experience in the public health service, Mr. Hyde has had a varied experience as a constructing and consulting engineer, and has designed a number of important water-supply and sewerage works in California. In July, 1905, Mr. Hyde accepted an appointment in the Engineering Faculty of the University of California, and since 1909 has held the Professorship of Sanitary Engineering in that university. Professor Hyde is a member of the American Society of Civil Engineers, the American Waterworks Association, the New England Waterworks Association, and many other scientific associations of standing.

*Carl Ewald Grunsky.*—Mr. C. E. Grunsky is a graduate with the Civil Engineer Diploma from the Polytechnicum of Stuttgart, Germany, and also holds the degree of "Doktor Ingenieur" from the same

institution. For ten years prior to 1888 Mr. Grunsky was Assistant and Chief Assistant State Engineer for California. He was then appointed by the Governor as a member of the Examining Commission on Rivers and Harbors of California. In 1894-95, he served as Consulting Engineer to the Commission of Public Works for California.

In 1904-05, Mr. Grunsky served by appointment of President Roosevelt as a member of the Isthmian Canal Commission, and in 1905 he was appointed Chief Consulting Engineer in the United States Reclamation Service. In addition to his extensive experience in public service, Mr. Grunsky has had a long and valuable experience in private practice.

Among the more notable pieces of scientific work which Mr. Grunsky has published is one on "The Sewer System of San Francisco and a New Solution of the Storm Water Flow Problem." This paper was based upon investigations carried on by the author while a member of the Board of Engineers to design a sewer system for San Francisco, and later while Engineer in Charge to complete these designs. For this work he was awarded the Norman Gold Medal of 1910 by the American Society of Civil Engineers.

*Ned Duncan Baker.*—Mr. N. D. Baker is a graduate of the University of California in Sanitary Engineering. Since graduation he has been engaged in special investigation work for the California State Board of Health. The first work assigned to Mr. Baker was a preliminary survey of the surface waters of the State. Subsequently, similar surveys were made for the sewage disposal methods and water supplies of selected cities and towns. His work has been uniformly thorough and of an exceptionally high order. Mr. Baker is a Junior Member of the American Society of Civil Engineers.

#### AN ACKNOWLEDGMENT.

The California State Board of Health deeply appreciates the coöperation not only of those engineers who have been mentioned above as contributing to the general study of the sewage disposal problem, but of those also who have prepared the reports on the new types of plants now under observation. All articles printed in the Bulletin are prepared by invitation from the secretary, and the authors receive no compensation other than that sense of satisfaction which may come as a result of disinterested coöperation in any great public welfare movement. The Health Conservation idea has taken a firm hold on Californians, and the State Board of Health believes the further development of this idea warrants a demand on the time of any citizen who may render aid. The promptness with which prominent men and women from every section of the State have met the request of the Board for coöperation in its part of this work is evidence that this belief is general.

#### AN ANNOUNCEMENT TO ENGINEERS.

To facilitate the work of engineers engaged in studying particular problems in sanitary engineering for the cities or counties of California, the State Board of Health is now prepared to furnish specific refer-

ences to all articles on matters pertaining to sanitary engineering that appear in current literature, especially in the following publications:

Engineering Record, beginning January, 1910.

Engineering News, beginning January, 1911.

Proceedings and Transactions American Society of Civil Engineers, beginning August, 1910. Also a few articles published previous to these.

The Board will be glad to answer any inquiries in this connection, and in giving references will give *all* that have been published in the above-named publications on the particular subject asked for, and will give the length of each article, its general trend, and its applicability to California conditions.

#### SANITARY ENGINEERING NUMBERS OF THE BULLETIN.

It is the purpose of the Board to devote a future number of the Bulletin to a series of popular articles on the water-supply problem for California cities. This important subject of water-purification methods will be presented in scientific but non-technical language. Professor Charles D. Marx, of Stanford University, who was prevented through illness from contributing to this Bulletin, will prepare the principal article.

#### THE IMHOFF TANK METHOD OF SLUDGE DISPOSAL.\*

Perhaps the latest development in the methods of handling sewage sludge is displayed in the design of the Emscher or Imhoff tank, used in Germany. This form of sewage tank was developed through the studies of Dr. Karl Imhoff, chief engineer of the sewerage department of a sanitary district in Germany.

The tank uses the same principle as the septic tank for the digestion of the sludge, but with variations that eliminate the objectionable features of that tank. The essential characteristic of the Imhoff tank is that it immediately separates the solids from the incoming sewage. These solids pass at once through slits in a hopper-shaped floor into a separate chamber or sludge-well. The liquid part of the sewage passes on, and, being in a fresh condition, is treated by sprinkling filters or contact beds to render it non-putrescible. If sufficient dilution-water is available, the settled sewage may be turned directly into it, as the chief cause of nuisance in such cases is the presence of solids.

The sludge-well is made about thirty feet deep, so that the sludge at the bottom is under a pressure of about two atmospheres. There is a constant supply of fresh solids being brought in and the bacterial action of purifying them goes on continuously. The gases given off are said to be mainly of the marsh-gas series, and are non-odorous and inoffensive. Just why sulphuretted hydrogen, so common in the gases from septic tanks, is not produced here is not yet definitely known.

The slots in the floor of the settling chamber are so arranged that gas

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\* This editorial was prepared by Mr. Baker, and is largely taken from several articles that recently appeared as follows:

"New Method of Handling Sewage Sludge," by Dr. Karl Imhoff and Mr. Chas. Saville, both of Essen, Germany. Engineering Record, December 10, 1910.

"A German Sanitary District and the Imhoff Sewage Purification Tank," by Chas. Saville, with introduction by Rudolph Hering. Engineering News, December 1, 1910.

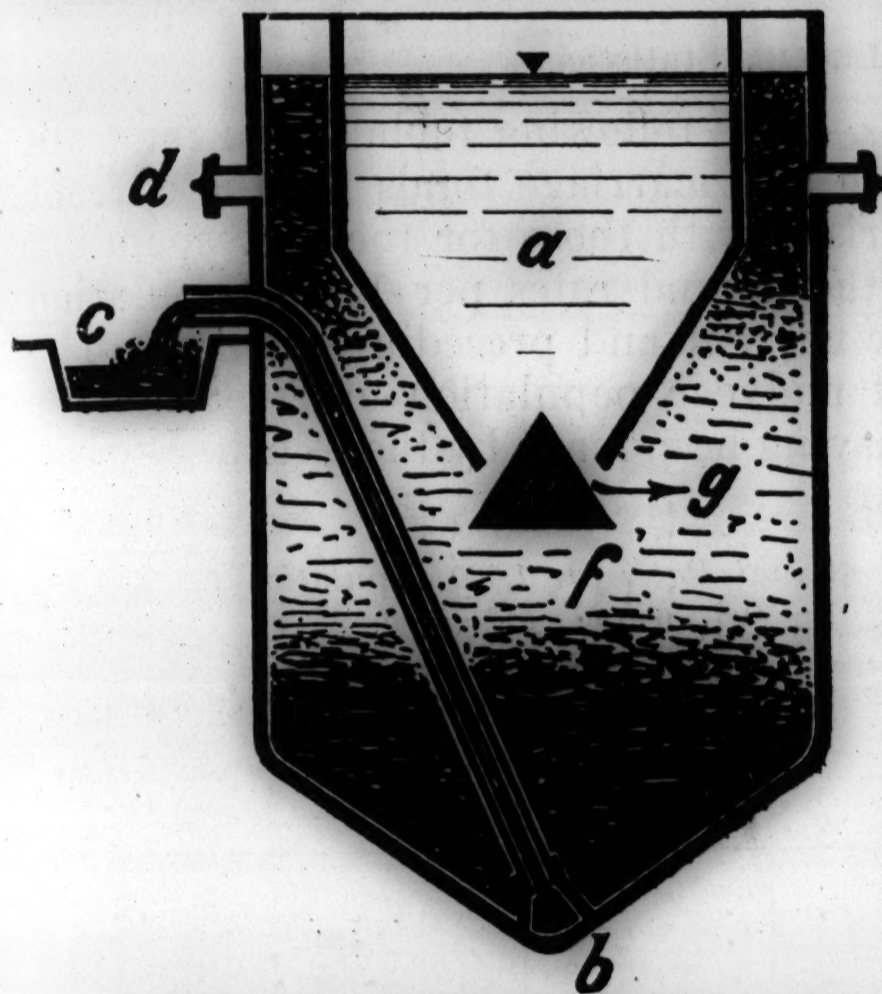
Editorial, "Revolutionary Improvements in Sewage Disposal," Engineering News, December 1, 1910, page 599.

"Some Recent Progress in Sewage Disposal," by Rudolph Hering. American Journal of Public Hygiene. Vol. 20, No. 4; New Series, Vol. 6, No. 4, Nov., 1910.

"The Peach Tree Creek Sewage Disposal Works at Atlanta, Ga." Engineering Record, December 31, 1910, page 769.

bubbles can not pass upward through them, and by this means the turbidity often present in septic tank effluents is avoided.

When the solids have been held in the sludge-well long enough to be thoroughly rotted out, a portion of the resultant sludge is drawn off through an outlet pipe extending from the bottom. The outlet of this pipe is below the surface of the sewage in the tank, so that the sludge is forced out by the water pressure. It is run by gravity on to sludge drying beds composed of clinker, with a thin top-dressing of sand. These beds are well under-drained with tile, and the sludge soon dries sufficiently to be spaded up and hauled away for filling low ground.



Cross section through sewage clarification tank:  
a, Sedimentation chamber; bc, sludge-pipe;  
d, scum outlet; f, sludge-well or decomposing  
room; g, slits connecting the sedimentation  
chamber with the sludge-well. The flow of  
sewage is perpendicular to the plane of the  
drawing. (Courtesy of Engineering Record.)

This dried sludge is described as being a "uniform dark-gray mass" of "unobjectionable earthy sludge."

Having been stored under pressure and being suddenly withdrawn, the sludge is made light by the expanding gases. So that on the drying beds the tendency is for the water to settle out below, rather than on top of it. As a result, the drying on the beds requires a minimum of time.

The advantages claimed for the Imhoff tank as a preliminary process over the septic tank are:

1. The plant in operation does not cause a nuisance from objectionable odors, either from gas from the tanks or from the removed sludge.

2. The effluent, being delivered to the filters in a non-sep-

tic condition, is much less offensive and more easily treated.

3. The bubbles from the "working" sludge, being unable to rise through the chamber through which the sewage passes, do not cause that turbidity of the effluent, so common in septic tanks from this reason.

4. The sludge, after being treated, is inoffensive and can be put on to land that can afterward be used for any purpose.

The most extensive system to be built in this country, involving the use of this form of tank, is that now being built at Atlanta, Ga. Experimental tanks have also been operated at Chicago and at Philadelphia, but the results have not been made public. Like the Cameron septic tank, the Imhoff tanks are covered by patents, but it is stated that the royalties charged for their use are extremely small.

Whether this process will ever be used in California to any great extent will depend on the extent to which it is applicable to California climate and conditions. It is very likely, however, that the next decade will see some Imhoff tanks installed in this State for preliminary treatment. The town of Winters has had plans prepared for a sewage disposal system based upon this principle.

## DEPARTMENT REPORTS.

### REPORT OF BUREAU OF VITAL STATISTICS FOR FEBRUARY.

GEORGE D. LESLIE, Statistician.

*State Totals and Annual Rates.*—The following table shows for California as a whole the birth, death and marriage totals for the current and preceding months in comparison with those for the corresponding months of last year, as well as the annual rates per 1,000 population represented by the totals for the current and preceding months. The rates are based on an estimated midyear population of 2,488,256 for California in 1911, the estimate having been made by the Census Bureau method with slight modifications.

*Birth, Death and Marriage Totals, with Annual Rates per 1,000 Population for Current and Preceding Months, for California: February.*

| MONTH.          | MONTHLY TOTAL. |       | Annual Rate<br>per 1,000<br>Population:<br>1911. |
|-----------------|----------------|-------|--|
|                 | 1911.          | 1910. |  |
| February—       |                |       |  |
| Births .....    | 2,530          | 2,454 | 13.3   |
| Deaths .....    | 2,788          | 2,605 | 14.6   |
| Marriages ..... | 1,785          | 1,684 | 9.4  |
| January—        |                |       |  |
| Births .....    | 2,601          | 2,488 | 12.3   |
| Deaths .....    | 3,192          | 2,833 | 15.1   |
| Marriages ..... | 1,981          | 1,747 | 9.4  |

The birth, death and marriage totals for California in February, as in January, were all greater than the corresponding totals for the same months last year. The birth-rate for February is somewhat greater than that for January, 13.3 against 12.3, while the death-rate for the current month is slightly less than that for the preceding month, 14.6 as compared with 15.1.

*County Totals.*—The following table shows the monthly birth, death and marriage totals for the principal counties of the State, the list being limited to counties having a population of at least 25,000 by the Federal Census of 1910. Totals are also shown for San Francisco and the other

bay counties (Alameda, Contra Costa, Marin, and San Mateo), as well as for Los Angeles and Orange counties together:

*Birth, Death and Marriage Totals, for Principal Counties: February.*

| County having at least 25,000 Inhabitants in 1910. | FEBRUARY, 1911. |         |            |
|--|-----------------|---------|------------|
|  | Births.         | Deaths. | Marriages. |
| California .....                                   | 2,530           | 2,788   | 1,785      |
| Alameda .....                                      | 239             | 252     | 155        |
| Butte .....  | 24              | 36      | 13         |
| Contra Costa .....                                 | 23              | 20      | 10         |
| Fresno .....                                       | 112             | 78      | 59         |
| Humboldt .....                                     | 41              | 38      | 18         |
| Kern .....   | 31              | 35      | 24         |
| Los Angeles .....                                  | 634             | 654     | 387        |
| Marin .....  | 24              | 10      | 85         |
| Orange .....                                       | 19              | 39      | 76         |
| Riverside .....                                    | 47              | 35      | 25         |
| Sacramento .....                                   | 70              | 103     | 43         |
| San Bernardino .....                               | 50              | 72      | 39         |
| San Diego .....                                    | 88              | 87      | 62         |
| San Francisco .....                                | 484             | 505     | 371        |
| San Joaquin .....                                  | 36              | 78      | 30         |
| San Mateo .....                                    | 36              | 21      | 30         |
| Santa Barbara .....                                | 25              | 25      | 16         |
| Santa Clara .....                                  | 122             | 119     | 49         |
| Santa Cruz .....                                   | 22              | 31      | 13         |
| Solano .....                                       | 23              | 34      | 8          |
| Sonoma .....                                       | 33              | 59      | 21         |
| Tulare .....                                       | 30              | 28      | 22         |
| Selected groups:                                   |                 |         |            |
| San Francisco and other bay counties .....         | 806             | 808     | 651        |
| Los Angeles and Orange counties .....              | 653             | 693     | 463        |

*City Totals.*—The table below gives the birth and death totals for the principal freeholders' charter cities, the list including all chartered cities with a census population of at least 15,000 in 1910. Totals are given likewise for San Francisco and the transbay cities (Alameda, Berkeley, and Oakland), as well as for Los Angeles and neighboring chartered cities (Long Beach, Pasadena, Pomona, and Santa Monica):

*Birth and Death Totals, for Principal Cities: February.*

| City having at least 15,000 Inhabitants in 1910. | FEBRUARY, 1911. |         |
|--|-----------------|---------|
|  | Births.         | Deaths. |
| Freeholders' charter cities .....                | 1,519           | 1,649   |
| Alameda .....                                    | 19              | 22      |
| Berkeley .....                                   | 36              | 27      |
| Fresno .....                                     | 41              | 29      |
| Long Beach .....                                 | 18              | 28      |
| Los Angeles .....                                | 433             | 448     |
| Oakland .....                                    | 167             | 157     |
| Pasadena .....                                   | 32              | 37      |
| Riverside .....                                  | 41              | 18      |
| Sacramento .....                                 | 43              | 70      |
| San Diego .....                                  | 38              | 59      |
| San Francisco .....                              | 484             | 505     |
| San Jose .....                                   | 44              | 36      |
| Stockton .....                                   | 7               | 30      |
| Selected groups:                                 |                 |         |
| San Francisco and transbay cities .....          | 706             | 711     |
| Los Angeles and neighboring cities .....         | 490             | 533     |

*Causes of Death.*—The following table shows the distribution of deaths in California for the current month, in comparison with the preceding month:

*Deaths from Certain Principal Causes, with Proportion per 1,000 Total Deaths for Current and Preceding Month, for California: February.*

| Cause of Death.                               | Deaths:<br>February. | Proportion per 1,000. |          |
|---|----------------------|-----------------------|----------|
|   |                      | February.             | January. |
| All causes.....                               | 2,788                | 1,000.0               | 1,000.0  |
| Typhoid fever.....                            | 35                   | 12.5                  | 11.3     |
| Malarial fever.....                           | 5                    | 1.8                   | 3.1      |
| Smallpox.....                                 | 1                    | 0.4                   | 0.3      |
| Measles.....                                  | 5                    | 1.8                   | 1.2      |
| Scarlet fever.....                            | 7                    | 2.5                   | 4.7      |
| Whooping-cough.....                           | 10                   | 3.6                   | 3.8      |
| Diphtheria and croup.....                     | 18                   | 6.5                   | 9.4      |
| Influenza.....                                | 23                   | 8.2                   | 8.8      |
| Other epidemic diseases.....                  | 10                   | 3.6                   | 4.7      |
| Tuberculosis of lungs.....                    | 354                  | 127.0                 | 132.2    |
| Tuberculosis of other organs.....             | 60                   | 21.5                  | 20.4     |
| Cancer.....                                   | 162                  | 58.1                  | 47.3     |
| Other general diseases.....                   | 103                  | 36.9                  | 42.9     |
| Meningitis.....                               | 36                   | 12.9                  | 10.3     |
| Other diseases of nervous system.....         | 236                  | 84.6                  | 81.8     |
| Diseases of circulatory system.....           | 476                  | 170.7                 | 159.1    |
| Pneumonia and broncho-pneumonia.....          | 289                  | 103.7                 | 134.7    |
| Other diseases of respiratory system.....     | 88                   | 31.6                  | 34.8     |
| Diarrhea and enteritis, under 2 years.....    | 43                   | 15.4                  | 17.2     |
| Diarrhea and enteritis, 2 years and over..... | 15                   | 5.4                   | 6.3      |
| Other diseases of digestive system.....       | 121                  | 43.4                  | 47.6     |
| Bright's disease and nephritis.....           | 186                  | 66.7                  | 63.3     |
| Childbirth.....                               | 29                   | 10.4                  | 9.1      |
| Diseases of early infancy.....                | 80                   | 28.7                  | 27.3     |
| Suicide.....                                  | 52                   | 18.7                  | 21.9     |
| Other violence.....                           | 205                  | 73.5                  | 54.5     |
| All other causes.....                         | 139                  | 49.9                  | 42.0     |

In February there were 476 deaths, or 17.1 per cent of all, from diseases of the circulatory system, and 414, or 14.9 per cent, from various forms of tuberculosis, heart disease thus leading tuberculosis considerably.

Other notable causes of death in February were: Diseases of the respiratory system, 377; diseases of the nervous system, 272; violence, 257; Bright's disease and nephritis, 186; diseases of the digestive system, 179; cancer, 162; and epidemic diseases, 114.

The deaths from epidemic diseases were as follows: Typhoid fever, 35; influenza, 23; diphtheria and croup, 18; whooping-cough, 10; and all other epidemic diseases, 28.

The deaths from the three leading epidemic diseases reported for February were distributed by counties as follows:

| TYPHOID FEVER.       |    | INFLUENZA.          |    | DIPHTHERIA AND CROUP |    |
|----------------------|----|---------------------|----|----------------------|----|
| Fresno .....         | 4  | Alameda .....       | 3  | Fresno .....         | 5  |
| Humboldt .....       | 1  | Fresno .....        | 1  | Los Angeles .....    | 2  |
| Imperial .....       | 1  | Los Angeles .....   | 5  | Mendocino .....      | 1  |
| Kings .....          | 2  | Mendocino .....     | 1  | Orange .....         | 1  |
| Lake .....           | 1  | Monterey .....      | 1  | Sacramento .....     | 1  |
| Los Angeles .....    | 3  | Nevada .....        | 1  | San Francisco .....  | 2  |
| Mendocino .....      | 2  | Orange .....        | 2  | San Joaquin .....    | 2  |
| Orange .....         | 1  | San Diego .....     | 1  | Tulare .....         | 4  |
| Riverside .....      | 2  | San Francisco ..... | 1  |                      |    |
| Sacramento .....     | 6  | San Joaquin .....   | 3  | Total .....          | 18 |
| San Bernardino ..... | 1  | Siskiyou .....      | 1  |                      |    |
| San Diego .....      | 2  | Stanislaus .....    | 1  |                      |    |
| San Francisco .....  | 5  | Tehama .....        | 1  |                      |    |
| Santa Barbara .....  | 1  | Yolo .....          | 1  |                      |    |
| Santa Clara .....    | 1  |                     |    |                      |    |
| Sierra .....         | 1  | Total .....         | 23 |                      |    |
| Tulare .....         | 1  |                     |    |                      |    |
| Total .....          | 35 |                     |    |                      |    |

*Geographic Divisions.*—Data for geographic divisions, including the metropolitan area, or “Greater San Francisco,” are as follows:

*Deaths from Main Classes of Diseases, for Geographic Divisions: February.*

| Geographic Division.               | DEATHS: FEBRUARY. |                        |                               |              |                                 |                                      |                                      |                                   |                                      |                |                       |
|------------------------------------|-------------------|------------------------|-------------------------------|--------------|---------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|----------------|-----------------------|
|                                    | All Causes.....   | Epidemic Diseases .... | Tuberculosis (All Forms)..... | Cancer ..... | Diseases of Nervous System..... | Diseases of Circulatory System ..... | Diseases of Respiratory System ..... | Diseases of Digestive System..... | Bright's Disease and Nephritis ..... | Violence ..... | All Other Causes..... |
| THE STATE .....                    | 2,788             | 114                    | 414                           | 162          | 272                             | 476                                  | 377                                  | 179                               | 186                                  | 257            | 351                   |
| Northern California .....          | 357               | 16                     | 40                            | 15           | 36                              | 58                                   | 50                                   | 21                                | 19                                   | 46             | 56                    |
| Coast counties ..                  | 175               | 8                      | 18                            | 8            | 22                              | 32                                   | 22                                   | 12                                | 9                                    | 24             | 20                    |
| Interior counties ..               | 182               | 8                      | 22                            | 7            | 14                              | 26                                   | 28                                   | 9                                 | 10                                   | 22             | 36                    |
| Central California ..              | 1,495             | 65                     | 200                           | 92           | 138                             | 257                                  | 206                                  | 103                               | 107                                  | 146            | 181                   |
| San Francisco ..                   | 505               | 13                     | 64                            | 28           | 40                              | 112                                  | 65                                   | 38                                | 30                                   | 48             | 67                    |
| Other bay counties .....           | 303               | 11                     | 40                            | 29           | 33                              | 49                                   | 43                                   | 20                                | 20                                   | 25             | 33                    |
| Coast counties ..                  | 192               | 4                      | 24                            | 8            | 23                              | 45                                   | 33                                   | 9                                 | 9                                    | 18             | 19                    |
| Interior counties ..               | 495               | 37                     | 72                            | 27           | 42                              | 51                                   | 65                                   | 36                                | 48                                   | 55             | 62                    |
| Southern California ..             | 936               | 33                     | 174                           | 55           | 98                              | 161                                  | 121                                  | 55                                | 60                                   | 65             | 114                   |
| Los Angeles .....                  | 654               | 19                     | 126                           | 41           | 60                              | 109                                  | 82                                   | 39                                | 48                                   | 42             | 88                    |
| Other counties ..                  | 282               | 14                     | 48                            | 14           | 38                              | 52                                   | 39                                   | 16                                | 12                                   | 23             | 26                    |
| Northern and Central California .. | 1,852             | 81                     | 240                           | 107          | 174                             | 315                                  | 256                                  | 124                               | 126                                  | 192            | 237                   |
| Metropolitan area .....            | 808               | 24                     | 104                           | 57           | 73                              | 161                                  | 108                                  | 58                                | 50                                   | 73             | 100                   |
| Rural counties ..                  | 1,044             | 57                     | 136                           | 50           | 101                             | 154                                  | 148                                  | 66                                | 76                                   | 119            | 137                   |

# REPORT OF PURE FOODS AND DRUGS LABORATORY FOR FEBRUARY, 1911.

PROFESSOR M. E. JAFFA, Director.

The following is a list of the persons accused, the foods found to be adulterated or mislabeled, and the nature of the offenses, which were included in the reports of the Director of the State Laboratory to this Board for the month of February. These persons were afforded an opportunity to be heard before this Board as provided in said act, and after such hearing, the findings of the Director being sustained, these cases were referred to the district attorneys of the several counties for prosecution:

## Laboratory Examinations and Analyses.

| Certificate No. | Material.                   | Violation.  | Name of Dealer.  | Locality.   |
|-----------------|-----------------------------|---|--|-------------|
| 1176            | Headache powders. Crown     | Mislabeled. False statement                         | Carter's Pharmacy  | Los Angeles |
| 1192            | Headache powders            | Mislabeled. Acetanilid                              | G. L. Robins   | Porterville |
| 1193            | Syrup, cream and maple      | Mislabeled. Under weight                            | Berkshire Maple Sugar Co.                                  | Los Angeles |
| 1194            | Water, California Club      | Mislabeled. False and misleading statements         | E. C. Fennesy, superintendent dining cars, S. L. R. R. Co. | Los Angeles |
| 1195            | Cider compound. Sweet apple | Mislabeled. Below standard. Ash, contains benzoates | Coca-Cola Bottling Works                                   | Los Angeles |
| 1196            | Headache wafers             | Mislabeled. Acetanilid                              | White Front Drug Store                                     | Porterville |
| 1197            | Laxative cough syrup        | Mislabeled. Alcohol and chloroform                  | J. Askenasy  | Los Angeles |
| 1198            | Laxative cold tablets       | Mislabeled. Acetanilid                              | San Joaquin Drug Co., incorporated                         | Fresno      |
| 1199            | Witch hazel                 | Mislabeled. Ethyl alcohol                           | J. M. Boynton  | Visalia     |
| 1200            | Arnica, tincture            | Mislabeled. Ethyl alcohol                           | Baer Bros.   | Bakersfield |
| 1203            | Listerine                   | Mislabeled. Ethyl alcohol                           | J. A. Hughes   | Bakersfield |
| 1204            | Sweet spirits nitre         | Mislabeled. Ethyl alcohol, ethyl nitrite            | Bakersfield Drug Co.                                       | Bakersfield |
| 1205            | Alum, powdered              | Adulterated. Per cent ammonia                       | Monroe Drug Co.  | Fresno      |
| 1206            | Peppermint, essence         | Mislabeled. Ethyl alcohol                           | G. L. Robins   | Porterville |

Laboratory Examinations and Analyses—Continued.

| Certif-<br>cate No. | Material.                        | Violation.                    | Name of Dealer.                   | Locality.     |
|---------------------|----------------------------------|-------------------------------|-----------------------------------|---------------|
| 1207                | Witch hazel, extract             | Mislabeled. Ethyl alcohol     | W. M. Nefton                      | Hanford       |
| 1208                | Peppermint, essence              | Mislabeled. Ethyl alcohol     | J. O. Robinson                    | Fresno        |
| 1209                | Sulphur, precipitated            | Adulterated. Per cent residue | The Modern Pharmacy               | Fresno        |
| 1210                | Liquid shampoo                   | Mislabeled. Ethyl alcohol     | Geo. F. Nidever                   | Fresno        |
| 1211                | Pond's extract                   | Mislabeled. Ethyl alcohol     | E. Gottschalk & Co., incorporated | Fresno        |
| 1212                | Foley kidney cure                | Mislabeled. Ethyl alcohol     | Lindsay Drug Co.                  | Lindsay       |
| 1213                | Tomatoes                         | Mislabeled. Underweight       | Weinstein Co.                     | San Francisco |
| 1214                | Cocktail, Jefferson              | Mislabeled. Underweight       | Pacific Syndicate Co.             | San Francisco |
| 1215                | Whiskey                          | Mislabeled. Underweight       | Jos. C. Haslam (Spreckels Market) | San Francisco |
| 1216                | Brandy, California               | Mislabeled. Underweight       | Jos. C. Haslam                    | San Francisco |
| 1217                | Gin, Club House                  | Mislabeled. Underweight       | Jos. C. Haslam                    | San Francisco |
| 1229                | Camphorated oil                  | Adulterated. Below standard   | Gleason-Courneon Drug Co.         | San Francisco |
| 1230                | Camphorated oil                  | Adulterated. Below standard   | Reliable Drug Co.                 | San Francisco |
| 1254                | Witch hazel                      | Mislabeled. Ethyl alcohol     | A. E. Scamell                     | San Francisco |
| 1260                | Balsam for lungs. Dr. Wm. Hall's | Mislabeled. Ethyl alcohol     | Bayly Drug Co.                    | San Francisco |
| 1264                | Grippe powders                   | Mislabeled. Acetphenetidine   | Shumate's Pharmacy                | San Francisco |

During the month of February there have been received at the State Laboratory 277 samples for examination and analysis. Of these, about three fourths were samples of foods or food products, while about one fourth consisted of drugs. The drug samples included patent medicines, tinctures, herbs, precipitated sulphur, headache powders, etc. The food samples comprised beverages, condiments, spices, extracts, pickles, eggs, butter, chopped meat, lard, etc.

#### LABELING OF SAGO AND TAPIOCA PREPARATIONS.

In the December, 1910, number of the California State Board of Health Bulletin there was printed in full a copy of Food Inspection Decision No. 128 *in re* the labeling of sago and tapioca. In accordance with the wording of the decision, only those preparations from the starch obtained from the pith found in the stem of several species of palm trees, native of the East Indies, can properly be labeled sago. All preparations obtained or prepared by heating, in a moist state, the starch made from the root of the cassava or tapioca plant should be labeled tapioca. Both products ordinarily reach the consumer in granulated form and are designated as "pearl sago" and "pearl tapioca," respectively. While "pearl sago" and "pearl tapioca" are separate and distinct articles of commerce, each resembles the other closely in appearance, and fine pearl tapioca frequently has been labeled and sold as sago.

It has come to the attention of the Food Inspection Commission of the State Board that there is very little real sago imported into the State, and most of the preparations now on the market labeled sago consist of small "pearl tapioca." It is, therefore, advisable for all dealers to be certain that their preparations are properly labeled, as all mislabeling will be treated as violation of the Pure Food Act, in accordance with the above referred-to decision, Food Inspection Decision No. 128.

#### LABELING OF DRUGS SOLD IN SEALED CARTONS.

Many inquiries have been made as to the requirements of the law with regard to the labeling of drugs sold in bottles or boxes which are inclosed in sealed cartons. The following rules will be observed by the State Board of Health and its inspectors:

1. In all cases, where any label is used, the carton must be properly and truthfully labeled on the outside thereof.
2. If the carton be properly and truthfully labeled, the bottle or box contained within it need bear no label whatever.
3. The bottle or box contained within the carton, if labeled at all, must be properly and truthfully labeled.
4. As to stock on hand prior to January 1, 1908, if the carton be properly and truthfully labeled, no prosecution will be instituted on account of a mislabeling of the box or bottle within. This exception will be in effect until September 1, 1911, and for no longer.
5. As used herein the term "properly labeled" means that the label shall be in the form, size and style required by the law, rules and regulations, and that the presence of substances required to be declared shall be suitably indicated. The term "truthfully labeled" means that the label shall not bear any statement, design, or device, regarding the article contained therein, which is false or misleading in any particular. The term "label" includes any word, design, or device blown upon the bottle.

#### LABELING OF FOODS PRESERVED WITH BENZOATE OF SODA.

Although the matter has long been settled by State and Federal rulings, inquiries are yet being received as to the proper manner of labeling foods preserved with benzoate of soda.

Under the ruling of the United States Department of Agriculture,

it is permitted to use benzoate of soda as a preservative of foods, *provided, that each container or package of such food is plainly labeled to show the presence and amount of benzoate of soda.* (Food Inspection Decision 104.)

The reason for the rule is that the consumer is entitled to be protected from deception by a declaration on the package advising him that the article has been artificially preserved.

Section 7 of the California Pure Foods Act, March 11, 1907, provides that the word "package" shall be construed to include any phial, bottle, jar, demijohn, carton, bag, case, can, box, or barrel or any receptacle, vessel or container of whatsoever material or nature which may be used for inclosing any article of food.

It results that the presence and amount of benzoate of soda must be plainly stated on each package of food as sold. The only instance in which this will not be insisted upon is that in which the large container from which sales in smaller quantities are made, properly labeled, is actually present *in full view of the purchaser when he buys.* If by reason of the fact that goods are ordered by mail, by telephone, or through a solicitor, or for any other reason, the properly labeled container is not actually present in full view of the purchaser at the time of the sale, the only label that can afford him any information is the label on the package delivered to him, and that must show the presence and amount of benzoate of soda, in every instance.

#### NOTICES OF JUDGMENTS.

The following notices of judgments have been received at the Laboratory since the publication of the last Bulletin. Full copies of notices may be obtained by addressing the Director of the State Food and Drug Laboratory, Berkeley, Cal.:

*Notice of Judgments Nos. 714 and 744.*—Adulteration of Tomato Pulp. Product consisted in whole or in part of a filthy, decomposed vegetable substance.

*Notice of Judgment No. 718.*—Misbranding of a drug product—"Stuart's Catarrh Tablets." Product consisted of compressed tablets, composed of sugar, talc, and calcium carbonate, sanguinarin, and flavored with sassafras. Analysis failed to show that product contained drugs possessing therapeutic properties adequate to attain the cures claimed for it—statements false and misleading.

*Notice of Judgment No. 719.*—Adulteration of Milk. Water had been mixed and packed therewith, so as to lower and reduce the quality of the milk.

*Notice of Judgment No. 720.*—Misbranding of Vinegar. Vinegar was not pure cider vinegar, but a mixture, or compound, prepared from unfermented apple juice and acetic acid, showing some vinegar.

*Notice of Judgment No. 721.*—Adulteration and Misbranding of Whey Product. (Sold as butter.) Said whey product had been shipped and delivered as butter, whereas one or more of the valuable constituents of butter had been wholly or in part abstracted therefrom. Water had been substituted wholly or in part for butter.

*Notice of Judgment No. 722.*—Adulteration and Misbranding of Bleached Flour. Substance known as nitrites, or nitrite, reacting material has been mixed and packed with said flour so as to reduce and lower and injuriously affect its quality and strength. Said flour has been mixed, colored and stained in a manner whereby damage and inferiority are concealed. The said flour has been caused to contain added poisonous or other added deleterious ingredients, etc. Label states flour is made from first quality hard wheat, whereas in truth and in fact it was made in whole or in part of wheat inferior to first quality hard wheat, namely, yellow-berry and other inferior wheat.

*Notice of Judgment No. 723.*—Alleged Adulteration and Misbranding of Sugar. A substance had been mixed with the sugar, increasing the ash content and lowering the quality and character of the sugar.

*Notice of Judgments Nos. 724, 725.*—Adulteration of Ice Cream Cones. Product contained an added poisonous ingredient, to wit, boric acid, which rendered said ice cream cones injurious to health.

*Notice of Judgment No. 726.*—Adulteration and Misbranding of Bitters. Methyl alcohol has been mixed with said "Fernet Branca" so as to reduce and lower quality and strength.

*Notice of Judgment No. 727.*—Misbranding of a drug product—"Az-ma-Syde." Said drug contained a derivative of cocaine, to wit, cocaine hydrochloride and cocaine, and failed to bear a statement on the label thereof.

*Notice of Judgment No. 728.*—Misbranding of Linseed Meal. Contents of sacks contained 31.61 per cent protein, whereas label on tags states 34 per cent.

*Notice of Judgment No. 729.*—Misbranding of Chick Feed. Label on tag states, "protein 11 per cent, fat 4 per cent, fiber 4 per cent. Made from Kaffir corn, corn, grit, and field seeds," whereas the product was found to consist of moisture 11.12 per cent, ether extract 1.41 per cent, protein 8.75 per cent, crude fiber 1.89 per cent, reducing sugar 0.22 per cent, sucrose 0.28 per cent, and starch 55.73 per cent.

*Notice of Judgments Nos. 730 and 740.*—Adulteration and Misbranding of Vanilla Extract. Product was found to contain vanillin 0.248 per cent, coumarin 0.028 per cent, color caramel and alcohol by volume 7.54 per cent. Label states "Shepard's Vanilla," which statement is false and misleading, as the bottles contained little or no extract from the vanilla bean.

*Notice of Judgment No. 731.*—Adulteration and Misbranding of Cola Syrup. Product contained in barrel was a liquid, consisting essentially of sugar, caffeine, cocaine, and derivatives of cocaine, phosphoric acid, caramel, flavoring agents and water, and contents of said barrel had been mixed and packed with caffeine, cocaine and derivatives of cocaine and phosphoric acid, so as to injuriously affect its quality and strength.

*Notice of Judgment No. 732.*—Adulteration of Tomato Catsup. Product consisted in part of motile bacilli and mold, and was partly composed of putrid and decomposed matter, and filthy, putrid vegetable substance.

*Notice of Judgment No. 733.*—Adulteration and Misbranding of Extract of "Messina Lemon." Liquid contained no oil of lemon; whereas true extract of lemon and true extract of Messina lemon are made from and contain oil of lemon. A highly diluted alcoholic solution of citral had been substituted for the article.

*Notice of Judgment No. 734.*—Adulteration of Egg Noodles. Product consisted wholly or in part of a filthy, decomposed, and putrid animal substance.

*Notice of Judgment No. 735.*—Misbranding of a drug product called "Cocainized Pepsin Cinchona Bitters." Label purported to state that the drug contained pepsin, whereas in truth and in fact the product contains no pepsin; and furthermore alleging the product to be misbranded, in that the drug contained in the bottles contained 26 per cent more or less of alcohol by volume, which proportion of alcohol was incorrectly stated on the label.

*Notice of Judgment No. 736.*—Adulteration of Frozen Eggs. Said eggs were a filthy, decomposed, and putrid animal substance.

*Notice of Judgment No. 737.*—Adulteration and Misbranding of Wine. Label states, "Extra Sherry P. G. & Co.," and "Extra Port Wine P. G. & Co." Words "Extra Sherry" convey the meaning and impression that the wine was manufactured in a foreign country, to wit, Spain, whereas in truth and in fact it was not manufactured in Spain or from a Spanish product, but in the United States—adulterated, in that an artificial color with a mixture of coal-tar dyes had been used in the said article of food, thereby concealing inferiority of the said article, etc.

*Notice of Judgments Nos. 738-739.*—Adulteration and Misbranding of Flavoring Extracts. Said bottles did not contain extract of vanilla, half strength, but contained an artificially compounded solution flavored with vanillin and containing little or no extract from the vanilla bean. Compounded solution had been mixed and packed with said article so as to reduce, lower and injuriously affect its quality and strength.

*Notice of Judgments Nos. 741-742.*—Adulteration and Misbranding of soft drinks—(Ginger Ale and Cocoa Cream). Product was made of imitation ginger ale, containing benzoic acid, saccharine, capsicum, and caramel. Product was artificially colored,

whereby its inferiority was concealed. Product had been mixed with cocaine, caffeine, saccharine, and benzoic acid so as to injuriously affect its quality and strength.

*Notice of Judgment No. 743.*—Misbranding of a drug product—"Fernet-Milan Bitters." Bottles failed to bear statements on label of quantity of alcohol contained therein.

*Notice of Judgment No. 745.*—Misbranding of a drug product—"Ferro-China Antimalarico." Label failed to bear statement of alcohol contained therein.

*Notice of Judgment No. 746.*—Misbranding of Liqueur "Curacao." Labels indicated that contents of said jug were a foreign product, Republic of France, whereas in truth and in fact the contents were manufactured in the United States.

*Notice of Judgment No. 747.*—Adulteration of a desiccated Egg Product. Contents of barrel consisted of dried eggs, in which were dirt, egg shells, pieces of flies, and an excessive number of micro-organisms, by reason of which the product was filthy, putrid, etc.

*Notice of Judgments Nos. 748-749.*—Adulteration and Misbranding of Oats. Product consisted of a mixture of 68.4 per cent oats, 8.4 per cent barley, and 23.2 per cent weed seeds and chaff, which lowered and injuriously affected its quality.

*Notice of Judgment No. 750.*—Misbranding of a drug product—"Kurakoff." Package bore statements regarding said article, to wit, that said Kurakoff was a wonderful combination of Russian white pine and Mexican wild sage honey, with gums and oils, heretofore unused; which statements were false and misleading.

*Notice of Judgment No. 751.*—Misbranding of Olive Oil. Product was labeled so as to deceive and mislead the purchaser, in that said label indicated that the contents of the can contained one-half American gallon, whereas in truth and in fact it was 8.8 per cent short in volume.

*Notice of Judgments Nos. 752-759.*—Adulteration and Misbranding of Oats. Product consisted of a mixture of oats, barley, chaff and miscellaneous weed seeds. Sold as "No. 3 white oats."

*Notice of Judgment No. 753.*—Adulteration of Milk. Butter fat had been abstracted and left out, whole or in part.

*Notice of Judgment No. 754.*—Adulteration of Belladonna Root, Powdered Henbane, Powdered Gentian Root and Powdered Cloves-Amboyna. Products consisted of ground olive pits,  $\frac{1}{2}$ ; Hyoscyamus muticus, a dangerous adulterant; clove stalks,  $\frac{1}{2}$  to  $\frac{1}{3}$ .

*Notice of Judgments Nos. 755-756-757-758-794-798.*—Misbranding of Cotton Seed Meal; also Adulteration of percentage of Protein. Product mixed with cotton seed hulls; percentage of crude fat and crude fibre.

*Notice of Judgments Nos. 760-761-763-781.*—Adulteration of Tomato Catsup. Product consisted in whole or in part of a filthy, decomposed, or putrid vegetable substance, artificially colored.

*Notice of Judgments Nos. 762-767-801-803.*—Adulteration of Tomato Paste. Product consisted in whole or in part of a filthy, decomposed, putrid substance.

*Notice of Judgment No. 764.*—Misbranding of Extract of Wintergreen. Underweight.

*Notice of Judgments Nos. 765-766.*—Adulteration of Mincemeat. Product contained a deleterious ingredient, to wit, salicylic acid.

*Notice of Judgment No. 768.*—Adulteration and Misbranding of a food product—"New York Brand Extract Lemon Compound." Product was artificially colored with coal-tar dye, not declared on label; false and misleading statements on label.

*Notice of Judgment No. 769.*—Misbranding of a drug product—"Cold and Grippe Tablets-Laxative." False and misleading statements on label as to curative powers, etc.

*Notice of Judgments Nos. 770-771.*—Misbranding of Geneva Gin. Label indicated that contents was a foreign product, whereas, in fact, it was of domestic origin. Product contained quantity of alcohol, amount not declared on label.

*Notice of Judgment No. 772.*—Misbranding of Coffee. The word "Mocha" on package, which would lead the purchaser to believe that said food contained Mocha coffee, whereas, in fact, it did not contain "Mocha" coffee.

*Notice of Judgment No. 773.*—Misbranding of a drug product—"Gauvin's Aniseed Syrup." False and misleading statements on label.

*Notice of Judgment No. 774.*—Misbranding of Vanilla Flavor and Lemon Flavor. False and misleading statements on label. An imitation product, artificially flavored and colored, concealing inferiority.

*Notice of Judgment No. 775.*—Adulteration and Misbranding of Peppermint Extract. Product artificially colored with coal-tar dye. False and misleading statements on label.

*Notice of Judgment No. 776.*—Misbranding of Macaroni. Label represented the macaroni to be a foreign product, manufactured within the country of Italy, whereas said macaroni had not been manufactured in country of Italy, but manufactured in the United States.

*Notice of Judgment No. 777.*—Misbranding of a drug product—"Brant's Soothing Balm." False and misleading statements on label.

*Notice of Judgment No. 778.*—Adulteration and Misbranding of "Prime Italian Codfish." Label would lead purchaser to believe that the product was a foreign one, of Italy or of Italian waters, when in truth it was a product of North American waters and the United States.

*Notice of Judgment No. 779.*—Misbranding of Salt Fish. Label would lead purchaser to believe that the fish was a product of Italy, whereas it was a product of North American waters.

*Notice of Judgment No. 780.*—Misbranding of a drug product—"Tilden's Febrisol." Quantity of alcohol and acetanilide incorrectly stated on label.

*Notice of Judgment No. 782.*—Adulteration of Frozen Eggs. Product consisted in part of a filthy, decomposed, and putrid animal substance.

*Notice of Judgment No. 783.*—Misbranding of Olive Oil. Contents of cans consisted principally of cottonseed oil, whereas label indicated that contents were olive oil.

*Notice of Judgment No. 784.*—Adulteration and Misbranding of a drug product—"Kola" Syrup. Said jugs contained a liquid consisting essentially of caffeine, cocaine and derivatives of cocaine, phosphoric acid, sugar, water, etc., which injuriously affected the quality and strength. Product was also artificially colored.

*Notice of Judgment No. 785.*—Adulteration and Misbranding of "Red Seal" Cola Queen Syrup. Similar to Notice of Judgment No. 784.

*Notice of Judgment No. 786.*—Misbranding of Stock Feed. Percentage of protein and fiber contained in less amount than stated on label.

*Notice of Judgments Nos. 787-788.*—Adulteration of Milk. Butter fat had been left out or abstracted.

*Notice of Judgment No. 789.*—Adulteration of Shucked Oysters. Water had been substituted in part for and in place of oysters.

*Notice of Judgment No. 790.*—Adulteration of a food product—Maclaren's Imperial Cheese. Product contained a poisonous and deleterious ingredient, viz., sodium borate.

*Notice of Judgment No. 791.*—Misbranding of a drug product—"Sporty Days Invigorator." False and misleading statements.

*Notice of Judgment No. 792.*—Adulteration and Misbranding of a drug product—Spirits of Turpentine. Product contained a quantity of mineral oil, which had been mixed with and substituted for spirits of turpentine.

*Notice of Judgment No. 793.*—Misbranding of Table Syrup. Label stated 50 per cent maple syrup and 50 per cent cane syrup, whereas it contained 35 per cent maple syrup and 65 per cent cane syrup.

*Notice of Judgment No. 795.*—Misbranding of a drug product—"Anadol." Labels did not bear any statement as to the quantity of acetanilid contained in bottles.

*Notice of Judgment No. 796.*—Adulteration and Misbranding of Apple Phosphate. Cask contained a liquid which was not apple phosphate, but a liquid artificially compounded, containing alcohol, reducing sugars, glucose, etc.

*Notice of Judgment No. 797.*—Misbranding of a drug product—"Mixer's Cancer and Scrofula Syrup." False and misleading statements.

*Notice of Judgment No. 799.*—Adulteration of Flour. Substances known as nitrites, nitrite, reacting material, and nitrogen peroxide gas had been mixed with flour.

*Notice of Judgment No. 800.*—Adulteration of Tomato Pulp. Contents of barrels were in a filthy, decomposed and putrid condition, and unfit for human consumption.

*Notice of Judgment No. 802.*—Adulteration and Misbranding of Maple Sirup. Cane sugar sirup had been mixed with maple sirup to reduce and lower quality and strength.

*Notice of Judgment No. 804.*—Misbranding of Macaroni. Label would lead the purchaser to believe that the macaroni was a foreign product, whereas it was manufactured in the State of Maryland.

*Notice of Judgment No. 805.*—Adulteration of Spiced Catsup. Product consisted in part of a filthy and decomposed animal or vegetable substance.

The following food inspection decisions have been received at the Laboratory since the publication of the last Monthly Bulletin:

#### FOOD INSPECTION DECISION NO. 131.

##### THE COMPOSITION OF EVAPORATED MILK.

For a considerable period of time the Dairy Division of the Bureau of Chemistry has been conducting an extended investigation in regard to the manufacture of evaporated milk (i. e., unsweetened condensed milk) and the character of the milk used by the manufacturers. This investigation has been carried on through the various seasons of the year and in various parts of the country, so that knowledge has been obtained of the seasonal variations in milk from herds of different types, and the different manufacturing methods in use, as well as of the character of the finished product from many sources.

The fault of the standards, as approved by the committee on food standards of the Association of Official Agricultural Chemists and the Interstate Food Commission, published as Circular No. 19 of the Office of the Secretary, lies in the low percentage of fat in the total solids, namely, 27.5 per cent. This low figure the board believes has encouraged the use of a partially skimmed milk, which fact is amply borne out by the many analyses made in the department. Again, this standard of 28 per cent total solids in Circular No. 19 is one not easily attained in all localities of the United States, during all seasons, by the usual methods of manufacture under ordinary working conditions, with the production of a satisfactory marketable article.

Considering the natural variations in the richness of milk from different breeds of cows and at different times of the year, as well as the practical conditions of manufacture, the Department has decided upon the following requirements, which it considers reasonable and just, with respect to the manufacture and composition of evaporated milk (i. e., unsweetened condensed milk) :

(1) It should be prepared by evaporating the fresh, pure, whole milk of healthy cows, obtained by complete milking and excluding all milkings within 15 days before calving and 7 days after calving, provided at the end of this 7-day period the animals are in a perfectly normal condition.

(2) It should contain such percentages of total solids and of fat that the sum of the two shall be not less than 34.3 and the percentage of fat shall be not less than 7.8 per cent. This allows a small reduction in total solids with increasing richness of the milk in fat.

(3) It should contain no added butter or butter oil incorporated either with whole milk or skimmed milk or with the evaporated milk at any stage of manufacture.

In view of the well-known tendency of factory analyses—often of necessity made rapidly and by persons not skilled as analysts—to give results above the truth with respect to fat, and especially with respect to total solids, manufacturers are advised always to allow a safe margin between their factory practice and the above-stated requirements as to percentage composition. This can be done without difficulty in all localities and at all seasons of the year.

#### FOOD INSPECTION DECISION NO. 132.

##### THE USE OF HOMOGENIZED BUTTER AND SKIMMED MILK IN THE MANUFACTURE OF ICE CREAM.

Investigations have shown that there has lately come into use in the trade an apparatus known as a "homogenizer," which has the faculty of so disrupting the globules of fat that a whole milk homogenized does not permit the separation of the cream through the ordinary gravity methods. In like manner butter or other fat and skimmed milk passed through the homogenizer form a product from which the butter does not separate on standing and which resembles in its other physical characteristics whole milk.

Investigations have further shown that butter and skimmed milk are passed through the homogenizer to form a so-called "cream," which is used in place of real cream in the manufacture of ice cream.

The Board is of the opinion that skimmed milk and butter fat in appropriate proportions passed through the homogenizer are not entitled to the name of "milk" or the name of "cream," as the case may be, according to the quantity of fat which is present. The Board is further of the opinion that the product made from a homogenized butter or skimmed milk can not be properly called "ice cream."

#### FOOD INSPECTION DECISION NO. 133.

##### THE COLORING OF GREEN CITRUS FRUITS.

The attention of the Board of Food and Drug Inspection has been directed to the shipment in interstate commerce of green, immature citrus fruits, particularly oranges, which have been artificially colored by holding in a warm, moist atmosphere for a short period of time after removal from the tree. Evidence is adduced showing that such oranges do not change in sugar or acid content after removal from the tree. Evidence further shows that the same oranges remaining on the tree increase markedly in sugar content and decrease in acid content. Further, there is evidence to show that the consumption of such immature oranges, especially by children, is apt to be attended by serious disturbances of the digestive system.

Under the Food and Drugs Act of June 30, 1906, an article of food is adulterated "if it be mixed, colored, powdered, coated, or stained in a manner whereby damage or inferiority is concealed." It is the opinion of the Board that oranges treated as mentioned above are colored in a manner whereby inferiority is concealed and are, therefore, adulterated.

The Board recognizes the fact that certain varieties of oranges attain maturity as to size, sweetness, and acidity before the color changes from green to yellow, and this decision is not intended to interfere with the marketing of such oranges.

## REPORT OF THE STATE HYGIENIC LABORATORY FOR FEBRUARY.

WILBUR A. SAWYER, M. D., Director.

In order to assist health officers, lecturers, and teachers who are helping to safeguard the public health, the Director of the Laboratory has devised a bacteriological instruction outfit illustrating the scientific basis for many important hygienic measures. Suggestions by Dr. Snow, Secretary of the State Board of Health, by Miss Margaret Henderson, Instructor in Bacteriology in the University of California, and by Miss Boring, Lecturer for the State Board of Health, are responsible for many of the good points of the outfit.

The materials are packed in a strong wooden case, about ten inches long and five inches square on the end. Corrugated paper protects the glassware from breakage.

The following card of instructions accompanies each outfit:

This instruction outfit is the property of the California State Board of Health. Applications for the loan of such outfits for purposes of instruction should be made to Dr. Wm. F. Snow, Secretary of the State Board of Health, Sacramento, California. The outfits are loaned for temporary use and should be returned promptly (express prepaid) to the State Hygienic Laboratory, University of California, Berkeley, so that they may be reissued for the use of others.

### Summary of Examinations made in the California State Hygienic Laboratory during the month of February, 1911.

#### Main Laboratory at Berkeley:

| Condition suspected:       | Positive. | Negative. | Total.     |
|----------------------------|-----------|-----------|------------|
| Diphtheria .....           | 3         | 43        | 46         |
| Gonococcus infection ..... | —         | 1         | 1          |
| Malaria .....              | 1         | 1         | 2          |
| Rabies .....               | 1         | 4         | 5          |
| Tuberculosis .....         | 9         | 16        | 25         |
| Typhoid .....              | 4         | 11        | 15         |
| Water pollution .....      | —         | 3         | 3          |
| Miscellaneous .....        | 1         | 2         | 3          |
|                            |           |           | <u>100</u> |

#### Fresno Branch Laboratory:

|                      |   |   |          |
|----------------------|---|---|----------|
| Condition suspected: |   |   |          |
| Diphtheria .....     | — | 1 | 1        |
|                      |   |   | <u>1</u> |

#### Los Angeles Branch Laboratory:

|                      |   |   |          |
|----------------------|---|---|----------|
| Condition suspected: |   |   |          |
| Diphtheria .....     | 1 | 4 | 5        |
| Tuberculosis .....   | 1 | 1 | 2        |
| Typhoid .....        | — | 2 | 2        |
|                      |   |   | <u>9</u> |

Total number examinations ..... 110

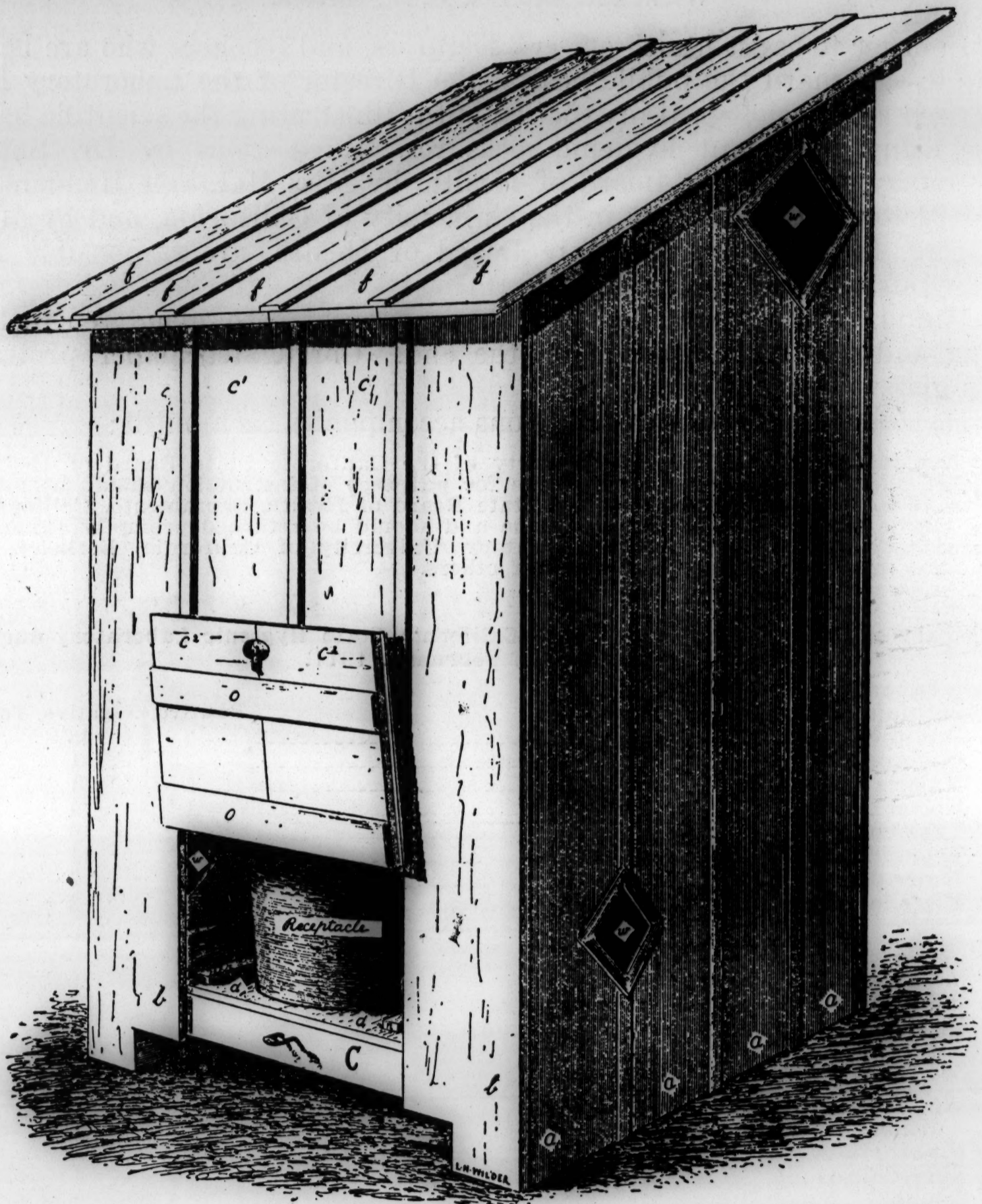
### EPIDEMIOLOGY REPORT.

The order of disease prevalence for the month of March, 1911, was as follows:

Measles, 284 cases in 14 places; scarlet fever, 181 cases in 12 places; whooping-cough, 135 cases in 10 places; diphtheria, 83 cases in 13 places; typhoid fever, 31 cases in 5 places; smallpox, 21 cases in 6 places; malaria, 21 cases in 4 places.

### THE PROBLEM OF THE HOUSE WITHOUT A MUNICIPAL SEWER.

The cut below illustrates the type of sanitary privy which is being advocated throughout the Southern States.



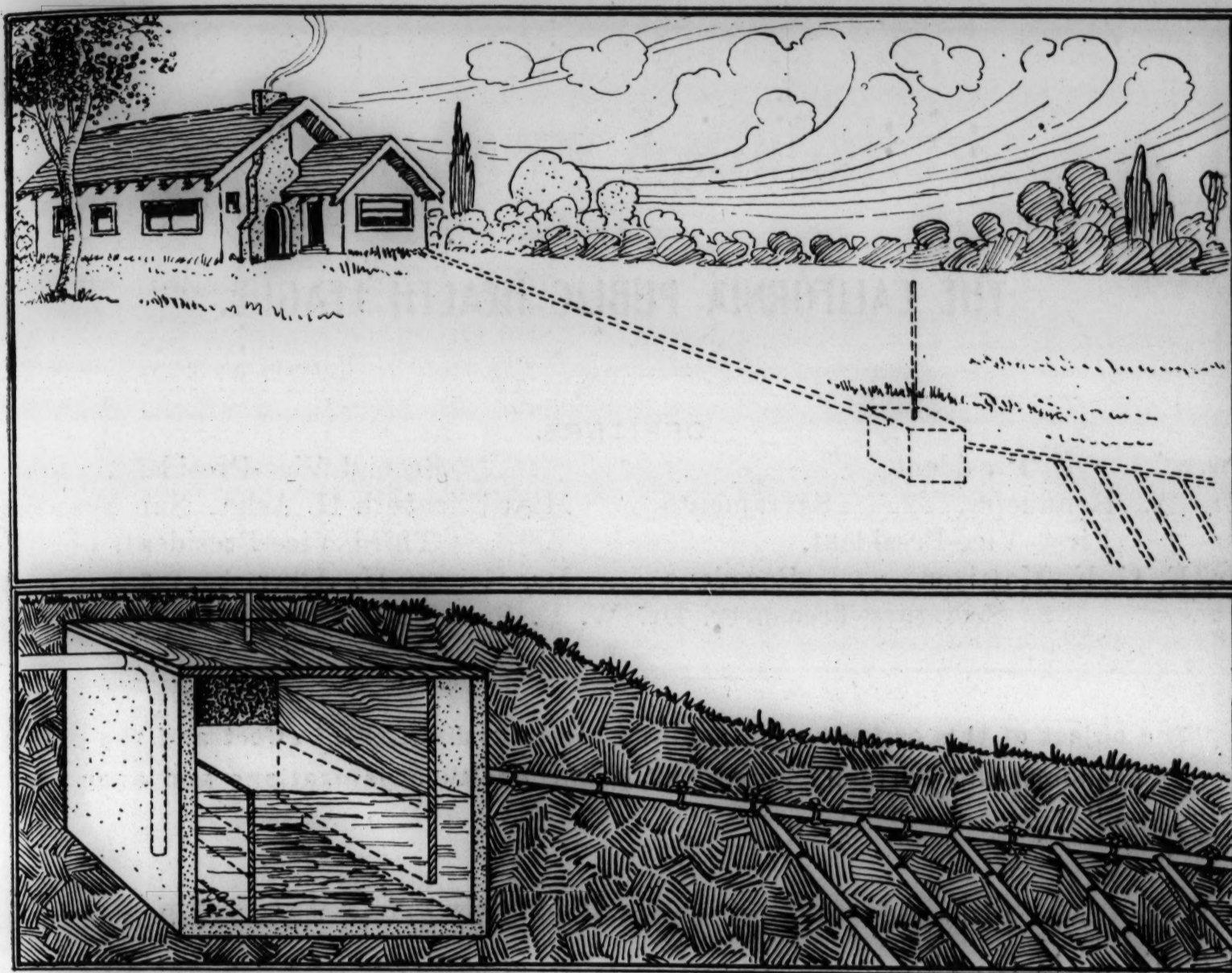
(See California State Board of Health Bulletin, Nov. 1910, for complete description.)

### THE PROBLEM OF THE SMALL SEWAGE-DISPOSAL WORKS.

In response to numerous requests for advice about sewage disposal for private houses and farms, the Board published the drawing which is printed on the opposite page to illustrate the general principles of the "septic" tank treatment and disposal by subsurface discharge.

The success of such a plant depends on the character of the sewage, its amount, the nature of the soil into which the discharge is made, and many other factors which require the consideration of a sanitary engineer in each individual case to insure good results.

In a loose, gravel soil such systems have done well, though oftentimes they become clogged after a varying period of use.



Any person may obtain a quotation in his own community on the materials listed below. To this estimate he has only to add the cost of labor. Cut "A" shows the general arrangement of a septic tank in relation to a farm house or country residence. It also shows the subsoil irrigation method of disposing of the effluent. Cut "B" shows a scale drawing of this septic tank.

*Bill of Material for the Construction of the Above Septic Tank.*

| <i>For Concrete Tank.</i>                  |         | <i>For Wooden Tank.</i>                           |         |
|--|---------|---|---------|
|  | Cost.   | Box.  | Cost.   |
| 1 barrel cement-----                       | \$----- | 4 pieces 2"x 4"x4' plank-----                     | \$----- |
| 52 lbs. hydrate of lime-----               | -----   | 22 pieces 1"x12"x4' 4" plank-----                 | -----   |
| 57/100 cubic yard sand-----                | -----   | 14 pieces 1"x12"x4' plank-----                    | -----   |
| 86/100 cubic yard broken stone-----        | -----   | 2 pieces 1"x 6"x4' plank-----                     | -----   |
| 1 piece 1"x12"x18' lumber-----             | -----   | 2 pieces 1"x 8"x4' 4" plank-----                  | -----   |
| 1 piece 1"x 8"x10' lumber-----             | -----   | 2 pieces 1"x 6"x4' 4" plank-----                  | -----   |
| 2 pieces 1"x12"x10' lumber-----            | -----   | 2 pieces 1"x 4"x4' 4" plank-----                  | -----   |
| 2 pieces 1"x12"x14' lumber-----            | -----   | 2 pieces 1"x 8"x4' plank-----                     | -----   |
| 2 lengths 2"x2' 6" wrought iron pipe-----  | -----   |   |         |
| 1 4" elbow-----                            | -----   | <i>Inside Walls and Top.</i>                      |         |
| 1 1"x6" brass nipple-----                  | -----   | 1 piece 1"x12"x18'-----                           | -----   |
| 1 1" elbow-----                            | -----   | 1 piece 1"x 8"x10'-----                           | -----   |
| 1 length 1"x3' 3" gal. iron pipe-----      | -----   | 2 pieces 1"x12"x10'-----                          | -----   |
| 1 1"x3" gal. iron nipple-----              | -----   | 2 pieces 1"x12"x14'-----                          | -----   |
| 1 3"x3"x $\frac{3}{8}$ " floor flange----- | -----   | Other items as scheduled in left-hand column----- | -----   |
| ( $\frac{3}{4}$ " threaded hole.)-----     | -----   |   |         |
| 8 feet $\frac{3}{4}$ " vent pipe-----      | -----   | Total-----  | \$----- |
| 1 gal. iron weir (see sketch)-----         | -----   |   |         |
| (Form Lumber.)-----                        |         |   |         |
| 4 pieces 2"x 4"x4'-----                    | -----   |   |         |
| 4 pieces 2"x 4"x4' 4"-----                 | -----   |   |         |
| 16 pieces 1"x12"x4'-----                   | -----   |   |         |
| 8 pieces 1"x12"x4' 8"-----                 | -----   |   |         |
| 8 pieces 1"x12"x5'-----                    | -----   |   |         |
| 2 pieces 1"x 4"x4' 8"-----                 | -----   |   |         |
| 2 pieces 1"x 4"x5'-----                    | -----   |   |         |
| 2 lbs. 10d. nails-----                     | -----   |   |         |
| Total-----                                 | \$----- |   |         |

NOTE.—All the above lumber to be of redwood.

## THE CALIFORNIA PUBLIC HEALTH LEAGUE.

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### OFFICERS.

|  |                                       |
|--|---------------------------------------|
| President,                                       | Second Vice-President,                |
| Mr. A. Bonnheim-----Sacramento                   | Miss Elizabeth H. Ashe--San Francisco |
| First Vice-President,                            | Third Vice-President,                 |
| Dr. F. C. E. Mattison-----Pasadena               | Dr. George H. Aiken-----Fresno        |
| Secretary-Treasurer, Dr. W. F. Snow, Sacramento. |                                       |

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"The object of this organization shall be the co-ordination of effort and the promotion of economy and harmony among all public health organizations and agencies in California."

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WHEREAS, This Association recognizes the great natural advantages of California for the development of high standards of physical efficiency and healthful environment, and

WHEREAS, California in common with other states permits much needless illness and loss of life because of inadequate organization and funds for health protection; and

WHEREAS, Health conservation rightly demands its place among the progressive conservation policies of the commonwealth; therefore be it

*Resolved*, That this Association recommends to the careful consideration of the citizens, the legislators, and the Governor of California, all practical measures for health conservation which may be advanced during the 1911 session of the legislature.

Names of officers and information concerning associations, which are members of the League, will be sent on application to the Secretary of the State Board of Health.

## LIST OF COUNTY HEALTH OFFICERS.

| County.         | Health Officer.                       | Address.        |
|-----------------|---------------------------------------|-----------------|
| Alameda         | Dr. C. L. McKown                      | Niles           |
| Alpine*         | County Recorder Frank Smith           | Markleeville    |
| Amador          | Dr. E. E. Endicott                    | Jackson         |
| Butte           | Dr. L. Q. Thompson                    | Gridley         |
| Calaveras       | Dr. E. W. Weirich                     | Angels Camp     |
| Colusa          | Dr. C. A. Poage                       | Colusa          |
| Contra Costa    | Dr. F. S. Gregory                     | Black Diamond   |
| Del Norte*      | County Recorder N. G. McVay           | Crescent City   |
| El Dorado       | Dr. S. H. Rantz                       | Placerville     |
| Fresno          | Dr. W. T. Burks                       | Fresno          |
| Glenn           | Dr. J. A. Randolph                    | Willows         |
| Humboldt        | Dr. E. H. Bryan                       | Eureka          |
| Imperial        | Dr. Virgil McCoombs                   | Imperial        |
| Inyo            | Dr. I. J. Woodin                      | Independence    |
| Kern            | Dr. G. M. Bumgarner                   | Bakersfield     |
| Kings           | Dr. Ralph Motherol                    | Hanford         |
| Lake            | Dr. W. E. Upton                       | Kelseyville     |
| Lassen          | Dr. D. E. Mason                       | Bieber          |
| Los Angeles     | Dr. F. O. Sawyer                      | Los Angeles     |
| Madera          | Dr. Mary R. Butin                     | Madera          |
| Marin           | Dr. J. H. Kuser                       | San Rafael      |
| Mariposa        | Dr. F. L. Wright                      | Mariposa        |
| Mendocino       | Dr. J. Liftchild                      | Ukiah           |
| Merced          | Dr. C. H. Castle                      | Merced          |
| Modoc           | Dr. John Stile                        | Alturas         |
| Mono*           | County Recorder Geo. Delury           | Bridgeport      |
| Monterey        | Dr. Garth Parker                      | Salinas         |
| Napa            | Dr. Adolph J. Kahn (County Physician) | Napa            |
| Nevada          | Dr. Carl P. Jones                     | Grass Valley    |
| Orange          | Dr. C. D. Ball                        | Santa Ana       |
| Placer          | Dr. G. H. Fay                         | Auburn          |
| Plumas          | Dr. F. D. Walsh                       | Quincy          |
| Riverside       | Dr. George E. Tucker                  | Riverside       |
| Sacramento      | Dr. Hugh Beattie                      | Elk Grove       |
| San Benito      | Dr. R. G. Curtis                      | Hollister       |
| San Bernardino  | Dr. D. C. Strong                      | San Bernardino  |
| San Diego       | Dr. Nathan Hunt                       | San Diego       |
| San Francisco   | Dr. W. F. McNutt, Jr.                 | San Francisco   |
| San Joaquin     | Dr. Wm. Friedberger                   | Stockton        |
| San Luis Obispo | Dr. H. M. Cox                         | San Luis Obispo |
| San Mateo       | Dr. W. G. Beattie                     | Colma           |
| Santa Barbara   | Dr. J. C. Bainbridge                  | Santa Barbara   |
| Santa Clara     | Dr. William Simpson                   | San Jose        |
| Santa Cruz      | Dr. W. R. Congdon                     | Santa Cruz      |
| Shasta          | Dr. F. Stabel                         | Redding         |
| Sierra          | Dr. R. B. Davey                       | Downieville     |
| Siskiyou        | Dr. F. J. McNulty (County Physician)  | Yreka           |
| Solano          | Dr. S. G. Bransford                   | Suisun          |
| Sonoma          | Dr. S. S. Bogle                       | Santa Rosa      |
| Stanislaus      | Dr. F. R. De Lappe                    | Modesto         |
| Sutter          | Dr. J. McFadyen                       | Yuba City       |
| Tehama          | Dr. J. S. Cameron                     | Red Bluff       |
| Trinity         | Dr. D. B. Fields                      | Weaverville     |
| Tulare          | Dr. M. E. Pettit                      | Visalia         |
| Tuolumne        | Dr. C. E. Congdon                     | Jamestown       |
| Ventura         | Dr. A. A. Maulhardt                   | Oxnard          |
| Yolo            | Dr. W. J. Blevins                     | Woodland        |
| Yuba            | Dr. J. H. Barr                        | Marysville      |

\*This county has not been able to arrange with any physician to serve as county health officer.

## PARTIAL LIST OF CITY HEALTH OFFICERS.

|                 |                           |                |                         |
|-----------------|---------------------------|----------------|-------------------------|
| Alameda         | Dr. L. W. Stidham         | Merced         | Dr. C. H. Castle        |
| Alhambra        | Dr. F. E. Corey           | Mill Valley    | Capt. M. Staples        |
| Alturas         | Dr. John Stile            | Modesto        | Dr. W. J. Wilhite       |
| Anaheim         | Dr. J. L. Beebe           | Mojave         | Mr. A. Smith            |
| Anderson        | Dr. J. H. Soothill        | Monrovia       | Dr. R. D. Adams         |
| Antioch         | E. C. Worrill             | Monterey       | J. E. Freeman           |
| Auburn          | Dr. R. F. Rooney          | Morgan Hill    | Dr. D. W. Watt          |
| Azusa           | Dr. S. A. Ellis           | Mountain View  | Dr. Philo Hull          |
| Berkeley        | Dr. J. J. Benton          | Napa           | J. D. Treadway          |
| Biggs           | Dr. B. Caldwell           | National City  | Dr. Theo. F. Johnson    |
| Black Diamond   | Dr. F. S. Gregory         | Nevada City    | Hugh Murchie            |
| Bakersfield     | Dr. G. M. Bumgarner       | Newman         | Dr. H. V. Armistead     |
| Calexico        | Dr. H. G. Richter         | Oakland        | Dr. E. N. Ewer          |
| Chico           | G. H. Taylor              | Ontario        | Dr. C. S. Orr           |
| Chino           | Dr. P. M. Savage          | Orange         | Dr. F. L. Champline     |
| Coalinga        | Dr. H. S. Warren          | Oroville       | Dr. W. F. Gates         |
| Colton          | Dr. J. A. Champion        | Oxnard         | Dr. Ralph W. Avery      |
| Colusa          | Dr. W. T. Rathbun         | Pacific Grove  | Dr. H. N. Yates         |
| Corona          | W. H. Chapman             | Palo Alto      | Hubert O. Jenkins       |
| Coronado        | Dr. Raffaele Lorini       | Pasadena       | Dr. Stanley P. Black    |
| Cottonwood      | Dr. A. B. Gilliland       | Petaluma       | Dr. R. B. Duncan        |
| Davis           | Dr. W. E. Bates           | Placerville    | Mr. P. J. Hall          |
| Doris           | Dr. A. A. Atkinson        | Pleasanton     | Dr. S. J. Wells         |
| Dixon           | Dr. R. L. Rierson         | Pomona         | Dr. T. J. Wilson        |
| Dunsmuir        | Dr. E. J. Cornish         | Piedmont       | Geo. T. Burtchael       |
| East San Jose   | Dr. W. A. Low             | Randsburg      | Mr. E. B. McGinnes      |
| Elsinore        | Dr. Hugh Walker           | Redding        | L. D. Poole             |
| Escondido       | Dr. David Crise           | Redlands       | Dr. J. M. Wheat         |
| Etna            | Dr. W. H. Haines          | Redondo Beach  | Dr. D. R. Hancock       |
| Eureka          | Dr. W. L. Perrott         | Redwood        | Dr. J. L. Ross          |
| Fairfield       | Dr. S. G. Bransford       | Richmond       | Dr. Chas. R. Blake      |
| Ferndale        | Dr. L. Michael            | Riverside      | Dr. Thos. R. Griffith   |
| Fort Bragg      | Dr. L. C. Gregory         | Rocklin        | Dr. S. P. Rugg          |
| Fort Jones      | Thos. Bransom             | Sacramento     | Dr. Wm. K. Lindsay      |
| Fresno          | Dr. Geo. H. Aiken         | Salinas        | S. A. McCollum          |
| Gilroy          | Dr. Jonas Clark           | San Bernardino | Dr. J. G. Ham           |
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